

RICE UNIVERSITY

**Stability of College Students' Fit with Their Academic Major and
the Relationship Between Academic Fit and Occupational Fit**

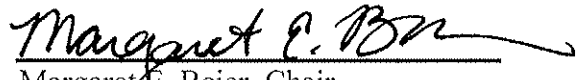
by


Louma Ghandour

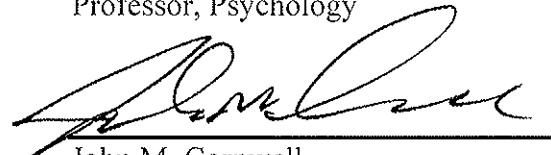
A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENT FOR THE DEGREE

Doctor of Philosophy

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HOUSTON, TX
NOVEMBER 2012

ABSTRACT

Stability of College Students' Fit with Their Academic Major and the Relationship Between Academic Fit and Occupational Fit

by

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This study examines the fit between students' interests and their academic choices at different stages of their college careers. Using image theory (Beach, 1990) as an integrated theory of person-vocation fit, this investigation focuses on the stability of academic fit during college and the relationship between fit with academic choice and fit with occupational choice. Participants, 257 students in their final year at Rice University, responded to questions about their interests as well as factors that may influence their career choices, such as parental support, work centrality, career efficacy, and employment potential. Results showed that students tend to improve their fit with their academic major during their first four semesters. And, students tend to maintain or improve their fit when they select their first occupation after college. Of the factors considered to influence career choices, work centrality, or the importance one places on work, moderated the relationship between academic and occupational fit.

Acknowledgements

I am grateful to Margaret Beier for her advice and guidance throughout my graduate career and particularly during the dissertation process. The writing process was like a relay race of editing, feedback, and modifications. From the start, she had the perfect combination of a critical eye and a gentle voice. Most of all, I thank her for helping me find my way back to being productive and seeing myself as a scientist. It is my sincere hope that this is the first of many projects together.

I would also like to thank my committee. Fred Oswald, John Cornwell, and Bridget Gorman provided insight and advice during the proposal stage that helped manage the scope of this effort. They were all incredibly responsive to a very aggressive timeline. Their constructive and timely feedback made this a better study.

I would like to acknowledge two people who bookended my academic career at Rice. I thank Dan Beal for his willingness to accept a non-traditional graduate student and Paula Sanders for her support as I transition to a full-time position.

This research would not have been possible without the use of two proprietary measures. Access to a reliable and valid measure of interests was critical for this study. For this, I thank Jeff Allen and Kyle Swaney at ACT for their advice, time, and assistance in obtaining permission to use the UNIACT. Nancy Betz was generous with her measure of career decision self-efficacy.

Graduate school in mid-life, with a job and a child in tow, would not have been possible without the incredible support of my family. I owe them very special thanks. Riham, Osman, Lana, and Joumana have been my constant cheering section, even when bewildered by my choices (... which seems to be always!). My husband and partner, Pat,

deserves an honorary degree of some kind for keeping me grounded with his steady presence, humor, and unwavering support. And, especially to Nyla – who has no memory of mom not being in school – may she find her *métier* and may she know that she can accomplish anything she chooses.

This study was funded, in part, by a gift from Shell to Rice's Center for Career Development.

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CHAPTER 1: INTRODUCTION

At a basic level, people have an intuitive understanding of fit. A high level of fit between people and their environments is attractive; we expect that individuals choose and are selected into environments that match their attributes and abilities (Ostroff & Schulte, 2007). We often ask questions about fit between an individual and his or her work. Does this job fit with her career objectives? Does his work-style fit with his supervisor's management style? Recruiters often use the term fit to reflect a level of correspondence or congruence between their hiring needs and a subset of relevant skills, knowledge, abilities, and characteristics of applicants. Employers refer to fit when explaining how and why a position or opportunity is positive, or negative, for a current or prospective employee. For many college students, fit begins with considering an area of study. It is not unusual for an undergraduate to be asked about his or her intended academic major and how this area of study fits with future career goals and aspirations.

Broadly speaking, person-environment (P-E) fit is defined as some form of agreement between characteristics of an individual and characteristics of his or her environment (Dawis & Lofquist, 1984; Schneider, 1987). Studies of P-E fit make a clear distinction between types of fit, which differ primarily by how the environment is defined (Kristof, 1996; Kristof-Brown, Zimmerman, & Johnson, 2005; Ostroff & Schulte, 2007). The environment can be described broadly with vocations (P-V fit; Holland 1966, 1996; Strong, 1943), or organizations (P-O fit; Cable & Judge, 1996; Chatman, 1991; Kristof, 1996), or more narrowly, with specific jobs (P-J fit; Kristof, 1996), teams or supervisors (Kristof, 1996; Judge & Ferris, 1993). The person component in P-E fit is represented by

relevant individual attributes and characteristics, such as interests, personality, abilities, knowledge, and values.

Fit between a person and the organization (P-O fit) typically represents how well a person's work values correspond to the organization's goals and mission (Kristof, 1996; Kristof-Brown et al., 2005). An employee who values autonomy and works at an organization that rewards individual contribution to its overall goals has good P-O fit. Congruence between the person and the job (P-J fit) is defined by how well the person's knowledge, skills and abilities correspond with those required by the position (Edwards, 1991). The correspondence of a mechanical engineer's skills, abilities, and knowledge of robotics with the job requirements of constructing a robotic arm for the Space Station is an example of P-J fit. If the engineer values the application of innovative ideas, then working at NASA is an example of P-O fit. P-O and P-J fit have been associated with desirable work outcomes such as performance, commitment, job satisfaction, and pro-social behaviors (see Kristof-Brown et al., 2005). P-O and P-J fit have also been used during the selection process (Cable & Judge, 1997; Cable & Yu, 2007; Kristof-Brown, 2000). In selection studies, both recruiters and applicants formed opinions of fit of individual-to-environment abilities and attributes during the interview process.

Interestingly, research on P-E fit began with person-vocation fit, or the fit between an individual's interests and an occupation's characteristics (Parsons, 1909; Strong, 1918). Person-vocation (P-V) fit has since become the purview of counseling psychology and its inclusion in I/O research has been limited (Kristof-Brown et al., 2005; Savickas, 2001; Vogel & Feldman, 2009). Studies of outcomes associated with P-V fit have been less consistent than other types of fit. Assouline and Meir's (1987) meta-analysis found small

positive relationships between P-V fit and performance and satisfaction ($\rho=.06$ and $.20$, respectively). In another meta-analysis, Tranberg and colleagues, (Tranberg, Slane, & Ekeberg, 1993), found no significant correlation between vocational fit and satisfaction. More recent studies have modeled P-V fit as an antecedent to P-O and P-J fit (Vogel & Feldman, 2009), and used as a predictor of task proficiency and continuance intentions in a military sample (van Iddekinge, Putka, & Campbell, 2001).

In his review of P-V fit, Spokane (1985) attributed inconsistencies in findings to the limited number of primary studies included in meta-analyses and the combining of college samples with those from work populations. He was also critical of the lack of distinction between measures of fit. Studies have typically measured P-V fit in one of two ways: perceived and objective. Perceived fit is measured by directly asking the individual how well their vocation or occupation matches their interests (Schmitt, Oswald, Friede, Imus, & Merritt, 2008); perceived fit is inherently a subjective measure. As the name suggests, objective fit relies less on the individual's perception. Rather, it is a computed comparison between an individual's interests and a classification of the occupation. Holland's (1959, 1997) common classification of occupations and interests is typically the foundation for measures of objective fit (Brown & Gore, 1994; Hoeglund & Hansen, 1999).

The proposed investigation focuses on P-V fit in an academic context: the fit between students' interests first with their choice of major and then with their choice of occupation. This research contributes to the extant literature by asking two questions. First, how stable is P-V fit in college? Second, how is fit with academic major during college related to fit with occupational plans after college; and, how do relevant

individual differences and situational factors influence this relationship? According to the U.S. Bureau of Labor Statistics (2010), young baby boomers changed jobs an average of 11 times when they were between the ages of 18-44. Therefore, a better understanding of how P-V fit changes has implications for understanding job satisfaction, job performance, and may have implications for selection.

I begin with a review of theories of P-V fit and its application in an academic context. I suggest that image theory (Beach, 1990) is a model of vocational fit that links fit with academic major to fit with occupational choice.

CHAPTER 2: LITERATURE REVIEW

History

Vocational fit has a long history of comparing individual attributes with characteristics of the work environment. This congruence-based approach to the study of occupational choice grew from a series of observational and empirical efforts, beginning with Parsons' work in the early 1900's. The world of work was changing, with an increase in immigration and a rise in manufacturing jobs (Fisk, 2001). The Vocation Bureau of Boston was created, in part, to assist men with the selection of an occupation (Parsons, 1909). Parsons' biggest contribution to the study of occupational choice is, arguably, his creation of a systematic evaluation process of the person and the work environment using a series of questionnaires that focused on abilities, personality, interests, temperament, and appearance. His model was based on matching self-knowledge with occupational characteristics to reach vocational options. He encouraged employers to avoid the cost and inefficiency due to the "... haphazard way by which young men and women drift into this or that employment, with little or no regard to adaptability..." (Parsons, 1909, p.98). He was a strong advocate of the scientific method and sought to apply an objective, analytical approach to the evaluation of occupational options. Even though his approach lacked a strong theoretical foundation, his work marked the beginning of congruence-based analysis of occupational choice research.

With World War I came the need to assign new military personnel into different roles (Strong, 1918). Strong developed an inventory that compared people in different occupations, and he grouped them based on similarities in their interests (Strong, 1943).

He demonstrated that the similarities in occupational interests in public administrators were distinct from those for a group of statisticians, forest supervisors, or chemists. Here, again, research was driven primarily by an empirical study with interest congruence between people in occupations as the focal argument and core concept.

Theory of Vocational Personalities

Holland (1959)

In the late 1950s, John Holland developed the most enduring congruence-based approach to occupational choice. The Holland theory of vocational personalities has dominated the field (Fouad, 2007; Nauta, 2010) and is the foundation for measurement of congruence (Hoeglund & Hansen, 1999) and more contemporary classifications of interest (Prediger, 1981). Holland extended Strong's (1943) notion that individuals in different occupations have distinct sets of interests. He posited that interests can be categorized, that an individual has an interest profile that forms an occupational personality, and that work environments can be described using the same classification system.

Congruence between the individual's profile and the work environment is beneficial for both the person and the organization (Holland, 1959, 1966, 1997). Holland classified vocational interests into six groups, known as the hexagon of interests: realistic, investigative, artistic, social, enterprising, and conventional (Figure 1). Realistic interests refer to practical, hands-on interests, such as construction and building; Investigative interests are those that focus on research and analysis; creative interests, such as art and music, fall under the Artistic cluster; Social interests are those that include helping and supporting; interests that require persuasion, are considered Enterprising interests; and,

Conventional interests are those related to organizing data and things (RIASEC). An interest profile places a person's interests in rank order. For example, if a person's highest interest area is investigative followed by realistic, enterprising, conventional, social, and artistic, then his or her full interest profile is IRECSA. An individual's Holland code refers to the highest-scoring three areas, thereby summarizing the person's predominant interests. In this example, the Holland code is IRE.

According to Holland, work environments can also be classified according to the RIASEC typology (Fouad, 2007; Holland, 1997; Nauta, 2010). Each occupation could be described using this same scheme. For example, scientific occupations that require research and analysis, such as physicist, are investigative professions. Helping professions, such as social work or counseling are considered social occupations. Enterprising interests include occupations that are based on persuasion, such as law, management, and sales; accounting is an example of a conventional profession. The combination of up to three types further describes occupations. So, investigative-artistic (IA) work environments differ from investigative-realistic (IR) ones in that the former refer to investigating with a creative purpose, such as astronomical research, whereas the latter suggests research conducted in order to produce something tangible, like mechanical engineering. Typically, work environments are classified by no more than three interest categories. There are two primary approaches to classifying occupational environments. The first is based on thorough job analyses. The second approach is more empirical. By averaging the scores of a representative number of people in each occupation, practitioners at Consulting Psychologist Press (CPP; Donnay, Thompson, Morris, & Schaubhut, 2004) and American College Testing (ACT; Tracey & Robbins,

2006; Tracey, Robbins, & Hofsess, 2005) have created proprietary classifications of occupational environments. Table 1 lists the definitions of each occupational category and examples of occupations in each of the six areas according to the Occupational Information Network (O*NET) created and maintained by the U.S. Department of Labor.

Holland recognized that there are individual differences in how well an individual's interests are defined. He identified two constructs to describe the clarity of interests: differentiation, and identity (Holland, 1997). Differentiation refers to how well interests are defined for an individual. It is the difference between the highest score in the profile and the lowest. Jane and Sarah might both have an ASEIRC rank order of preferences. However, if the difference between Jane's first and sixth preferences is lower than Sarah's, then Jane has a flatter, or less differentiated, interest profile. Identity is the "possession of a clear and stable picture of one's goals, interests, and talents" (Holland, 1997, p. 5). Holland developed an 18-item scale to measure the individual's level of certainty in his or her vocational choices (Holland, Gottfredson, & Power, 1980; Holland, Johnston, & Asama, 1993). In studies, vocational identity has been positively related job satisfaction ($r = .45$; Carson & Mowsesian, 1993), and career decision self-efficacy ($r = .58$; Koumoundourou, Kounenou, & Siavara, 2012). All else being equal, the better differentiated the profile and the stronger the identity, the more predictable the outcomes (Gottfredson & Duffy, 2008; Holland, 1997).

Ever the empiricist, Holland considered the continuity, or stability, of interest profiles the "most explicit success" of his vocational theory (Holland, 1996, p. 397). According to Holland, an interest profile is a representation of personality and, as such, should function as a trait. He expected interest profiles would be stable over time

(Holland, 1997). Since multiple occupations can be classified under the same interest code, it's worth noting that stability of fit is not stability in a specific job or occupation. If Patrick's interests are investigative, realistic, and conventional (IRC) and he changes his occupation from chemist (IRC) to mechanical engineer (also IRC), he has a stable fit. There is considerable evidence that interests are consistent over time. A recent meta-analysis by Low and colleagues (Low, Yoon, Roberts, & Rounds, 2005) found that vocational interest stability increases between the ages of 12 to 18, and then remains relatively constant for the next two decades ($\rho=0.67$).

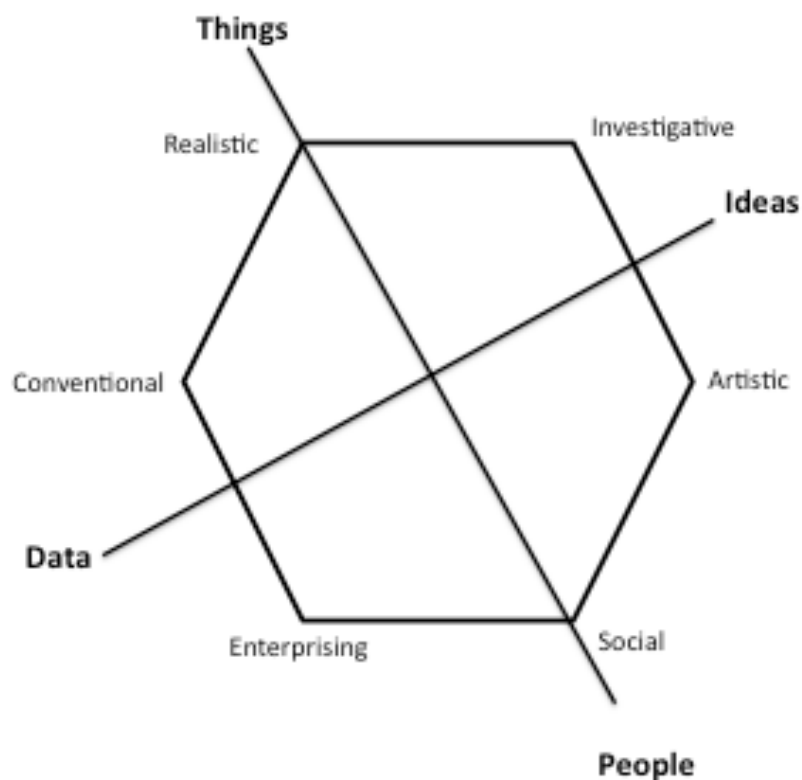
To sum, Holland (1959, 1997) theorized that people select occupations based on their interests, that interests can be measured and categorized, and that occupations can be similarly classified. This approach offered a theoretical foundation for developing hypotheses and testing predictions about the relationship between vocational interests and relevant outcomes, an element lacking in previous congruence-based approaches. He also defined constructs, such as differentiation and identity, that allow for differences in the clarity of interests. Research over four decades has supported his dispositional view of interests. In this dissertation, I rely on Holland's definition of vocational personalities when examining objective fit.

Table 1: Definition of occupational environments.

Interest area	Description	Sample Occupations
Realistic	Realistic occupations frequently involve work activities that include practical, hands-on problems and solutions. They often deal with plants, animals, and real-world materials like wood, tools, and machinery. Many of the occupations require working outside, and do not involve a lot of paperwork or working closely with others	Electrician (RIC) Civil Engineer (RIC) Police officer (REC) Landscape (RC)
Investigative	Investigative occupations frequently involve working with ideas, and require an extensive amount of thinking. These occupations can involve searching for facts and figuring out problems mentally.	Astronomer (IAR) I/O Psychologist (IEA) Biologist (IR) Internist (ISR)
Artistic	Artistic occupations frequently involve working with forms, designs and patterns. They often require self-expression and the work can be done without following a clear set of rules.	Cooks (ARC) Composers (AE) Graphic Designer (ARE) Technical Writer (AIC)
Social	Social occupations frequently involve working with, communicating with, and teaching people. These occupations often involve helping or providing service to others.	Elementary School Teacher (SAC) Registered Nurses (SIC) Counseling Psychologist (SIA) Clergy (SEA)
Enterprising	Enterprising occupations frequently involve starting up and carrying out projects. These occupations can involve leading people and making many decisions. Sometimes they require risk taking and often deal with business.	Advertising Manager (EAC) Bartender (ECR) Financial Manager (EC) Sales Engineer (ERI)

Interest area	Description	Sample Occupations
Conventional	Conventional occupations frequently involve following set procedures and routines. These occupations can include working with data and details more than with ideas. Usually there is a clear line of authority to follow.	Auditor (CEI) Gaming Dealers (CER) Bank Tellers (CE) Pharmacy Technicians (CR)

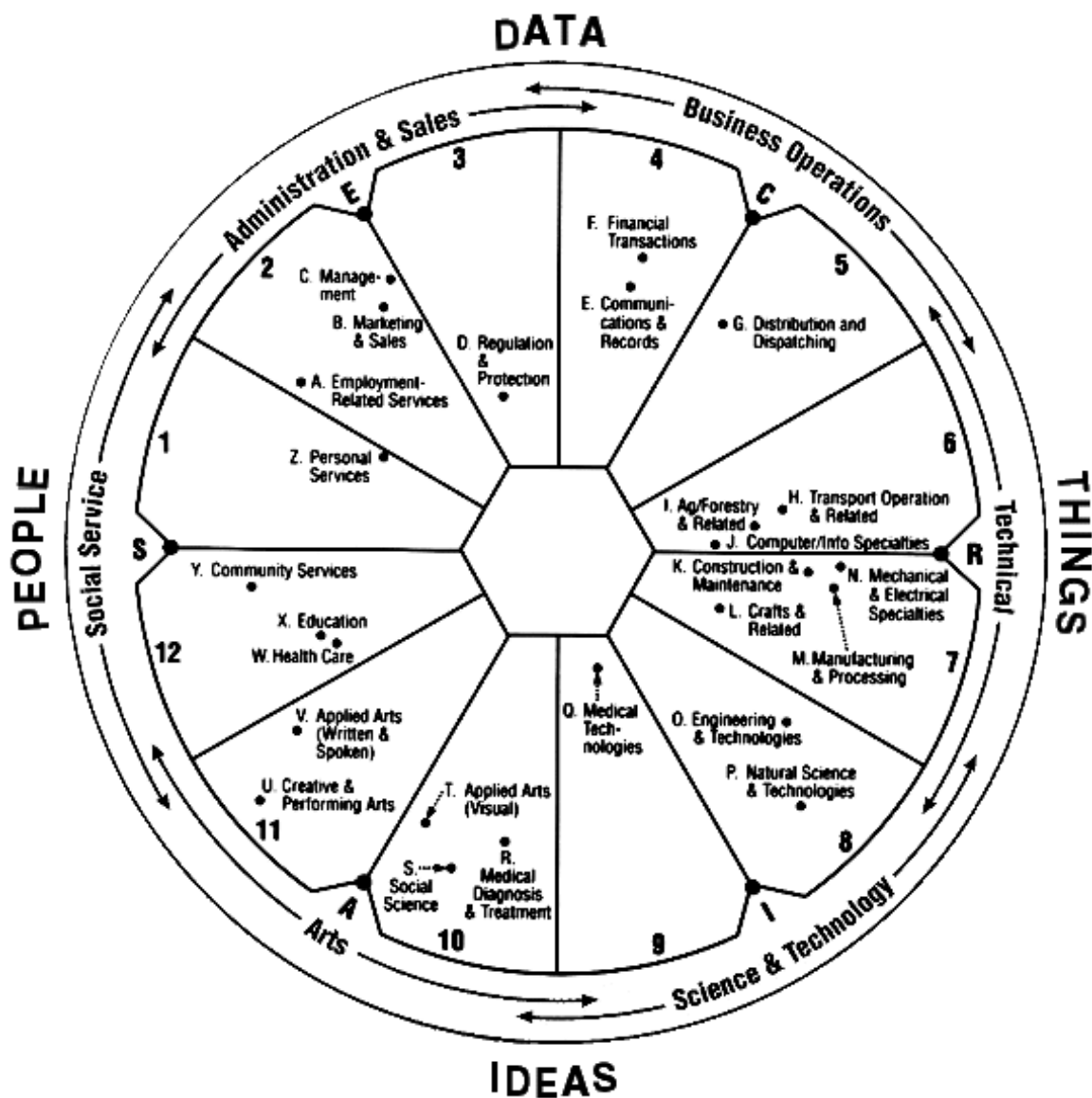
Figure 1. Holland's hexagon of interests (RIASEC). The definition of each of these categories is listed in Table 1. Super-imposed on the hexagon is Prediger's interpretation that places interests along two dimensions: things/people and data/ideas.



Prediger (1981)

Prediger (1981, 1982) sought to better relate Holland's classification of interests to work-related tasks. According to Prediger, people tend to have preferences along two dimensions: data vs. ideas, and people vs. things. The first dimension refers to an individual's preference for working on idea-related tasks, such as theories and abstract concepts, versus procedures and facts, or data-related tasks. The second dimension refers to preferring people-related tasks, such as helping, persuading, and directing others, to things-tasks that involve working with materials and tools. He mapped 3-letter Holland codes onto his two dimensional classification such that interests in people and things corresponded to one's realistic versus social interests. The orthogonal things-ideas axis placed the ideas pole between investigative and artistic interests and the data pole between enterprising and conventional interests (see Figure 1). A positive score on the Things/People dimension indicates a greater interest in things over people; a negative score indicates the person has a higher interest in People. Similarly, a positive score along the Data/Ideas dimension indicates a greater interest in data over ideas. Merging his two-dimensional classification with Holland's (1997) hexagon, Prediger divided the hexagon into twelve broad categories of occupations known as the World of Work Map (WWM; Figure 2). For example, regions one and twelve are both related to a preference for working with people and social occupations. Region one includes an additional preference for data (e.g., personal services), whereas region twelve integrates a preference for ideas (e.g., education).

Figure 2. ACT's World of Work Map (WWM; 1995, 2009). Holland's (1959) hexagon is mapped into two dimensions of things-people, data-ideas (Prediger, 1981). The WWM divides the hexagon into 12 sections.



Vocational Fit in an Academic Context

Vocational fit theories are widely applied in career counseling, particularly when advising students on which academic major to select (Savickas, 2001). Because the proposed study specifically examines vocational decisions in an academic context, I limit the discussion below to studies that have used vocational fit to specifically evaluate college-related outcomes.

Choice of Major

Due to its ease of use, accessibility, and intuitive appeal, Holland's work dominates in career counseling (Fouad, 2007; Nauta, 2010; Savickas, 2001). In an academic context, the vocational environment is the area of study, or academic major. Holland's (1997) vocational theory posits that a student will select an area of study in-line with his or her interests, and that a high level of fit between a student's interests and the major is beneficial. Some of Holland's early work used college samples to test the RIASEC hexagon (Holland, 1964, 1966). His classification of majors according to type served as the foundation for the Dictionary of Holland Occupational Codes (DHOC; Gottfredson & Holland, 1996). Holland also developed a self-assessment, the Self Directed Search (SDS; Holland, 1997) that allows individuals to prioritize their interests and helps teens and young adults to explore educational and occupational paths.

Performance

The research group at ACT has studied the relationship between fit with major and academic performance extensively using Prediger's (1981) two-dimensional classification. ACT has developed a proprietary inventory of interests that is included in

standardized testing for college admission. This assessment has allowed for some of the most robust evaluation of the relationship between fit and outcome measures. In a study of 80,574 students at 87 institutions, Tracey and Robbins (2006) found that objective fit between interests and major was predictive of first year GPA, second year GPA, and GPA at graduation, regardless of institutional differences.

Similar to meta-analyses of person-vocation fit (e.g., Spokane, 1985; Tranberg et al., 1993), not all studies have found support for the hypothesized relationship between fit and performance. In some cases objective fit has had an inconsistent relationship with first and third year GPA (Tracey, Allen, & Robbins, 2012). Wessel, Ryan, and Oswald (2008) classified students' interests and areas of study using Holland's taxonomy. The authors evaluated fit in two ways: perceived and objective. They assessed objective fit using two well-established congruence indices. The first was based on comparing Holland codes, and the second used the WWM. As discussed, perceived fit is a more subjective measure of fit in which the person is directly asked about their perception of fit with their major. Wessel and colleagues found that objective and perceived fit were uncorrelated and were differentially predictive of performance. Additionally, only the WWM-based index of objective fit was correlated with GPA ($r = .21$). Perceived fit was not related to overall GPA. These differences between measures of fit and outcomes suggest that it is prudent to use more than one measure of P-V fit.

Satisfaction

Fit has also been considered relevant to satisfaction. Schmitt et al. (2008) and Wessel et al. (2008) explored the relationship between fit with major and satisfaction. Schmitt and colleagues focused on the relationship between perceived fit and academic

satisfaction, whereas Wessel evaluated the relationship between both types of fit and satisfaction with the institution as well as affective commitment to the major. Schmitt et al. found a positive relationship between perceived fit at one time point and academic satisfaction at a subsequent point in time, ($r = .44$). In the Wessel et al. study, they found that only perceived, not objective, fit was predictive of affective commitment to the major ($r = .22$), and neither type of fit was related to satisfaction with the institution. This suggests that prediction is maximized when the criterion is mapped to the predictor space. In this case, focusing on outcomes specifically related to the major when considering relationships with fit with major is most appropriate.

Persistence

Persistence in the major has also been considered to be a desirable outcome of fit. Researchers at ACT, with their extensive database, have studied the relationship between interest-major fit and persistence in the major. Allen and Robbins (2010) found that interest-major congruence, together with first year GPA, predicted persistence in selected major between students' first and third year. The authors interpreted this result as support for Holland's theory of occupational preferences. The current study differs in interpretation of persistence. I am proposing to evaluate persistence in fit rather than persistence in a specific major.

In summary, studies support the notion that fit with academic choice is positively related to desirable college outcomes. These studies also show that how fit is measured is important – subjective and objective fit are differentially predictive of outcomes. Students who have higher objective fit tend to perform better and are more likely to persist in the major than students with lower objective fit; students with higher perceived fit tend to

have higher levels of satisfaction and affective commitment to their majors compared to students with lower perceived fit.

Image Theory

Image theory suggests that people make decisions based on images they hold (Beach, 1990). Compared with other decision-making theories, such as expectancy theory (Vroom, 1964) or subjective utility theory (Brooks & Betz, 1990), image theory focuses on what people actually do, rather than the more prescriptive approach of what they should do (Beach & Lipshitz, 1996; Beach & Mitchell, 1996). Image theory offers a decision-making model that helps explain what is termed, in the vernacular, intuition.

Images

Image theory posits that a person's decisions are based on his or her principles, goals, and plans (Beach & Mitchell, 1998). According to this theory, the decision-maker uses three sequential knowledge structures, or images, when considering decisions. First, value images are formed by the person's principles or values. Lynne just moved to Houston and is considering which sports activities to pursue. According to image theory, Lynne will have a value image of an active lifestyle. "Principles serve to internally generate candidate goals and plans for possible adoption, and they serve as criteria for decisions and adoption of externally generated candidates" (Beach & Mitchell 1998, p. 12). Lynne might then identify a series of potential activities that she might consider. Trajectory images reflect the decision-maker's goals. These goals represent the person's ideal achievements. Trajectory images can vary in specificity and immediacy. Running a 5K race in 30 minutes is an example of a specific trajectory, whereas adopting a healthier lifestyle is an example of a more abstract one. Strategic images, the third image in the

sequence, refers to the plans that have been adopted by the decision-maker in order to achieve his or her goals. Each person relies on his or her own set of decision-relevant images, termed working images, to make choices. The images apply to all life domains, including work, study, leisure, and personal/family decisions. Images can be described by strength and clarity of choice. Choice strength reflects the degree or certainty to which the decision is held. Choice clarity reflects the ability of the decision-maker to articulate and support the choice.

Decision processes

Image theory also considers the processes through which decisions are made. As Figure 3 illustrates, a person uses one of two tests in the decision-making process (Beach, 1990; Stevens, 1996): compatibility or profitability. The compatibility test is the process of screening possibilities and adopting the option most compatible with the person's image. If the scanning process results in only one candidate option, then the decision is made. Judging compatibility is hardest with distal and abstract trajectories, such as when a student is leveraging his or her academic career to prepare for their occupational career. When goals are not concrete, the decision-maker sifts through a wider range of goal attributes until ready to adopt a decision. The decision-maker maintains only the option(s) consistent with his or her set of working images.

The profitability test is a process used in tandem with compatibility. When compatibility yields multiple options, the individual then incorporates additional information to directly compare choices and opts for the best choice from the subset generated by the compatibility test. Take the example of an individual's plan to be employed – the search for a job and selection of an offer. Rose seeks a position in the

energy sector; she greatly values conservation and sees herself as an environmentalist. Rose considers organizations that focus on renewable and green energy. So, she uses a compatibility test to screen organizations, eliminating companies that do not have opportunities that fit her value and goal images. Then, as she goes through the recruitment process and opportunities become more specific and salient, Rose incorporates other factors, such as job location. She makes a choice by directly comparing offers with each other and accepts one position. Beach (1990) suggests that factors that influence choice in the profitability test include characteristics of the decision-maker, such as motivation, and salient environmental considerations, such as financial constraints.

Figure 3. The decision-making process in image theory. Adapted from Beach (1990, p. 7). In this model, the person first uses a compatibility test to identify candidate choices. If there are multiple survivors then the person compares these options directly with each other and incorporates additional information to adopt the best choice. Additional information can include characteristics of the decision-maker as well as relevant situational factors.

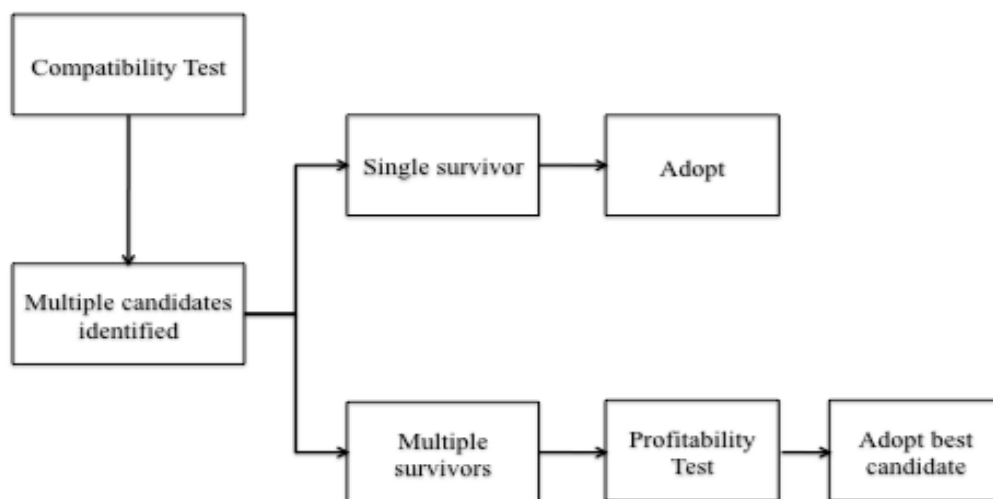


Image Theory and Occupations

The most direct discussion of image theory in occupational choice is a theoretical presentation by Stevens (1996, 1998). She applies image theory to career-related decisions by outlining how images, compatibility tests, and profitability tests apply to the job choice domain. Stevens considers the value image to be heavily influenced by childhood experiences. If Jane shares a high value of wealth with her parents, then she is likely to select an occupation that will be consistent with that image. If, however, she does not place a high value on wealth, she is more likely to explore occupations associated with different levels of income. In the context of career choice, Stevens (1998) proposed that individuals follow a profitability test to arrive at a choice.

Few empirical studies have applied image theory to occupational choice. In the most recent and direct application, Thompson and Dahling (2010) evaluated how value images of social status influenced career aspirations. Using a sample of undergraduates, the authors assessed students' value images in three areas: social status and perceptions of feminine and masculine gender roles. They also asked students about their career and leadership aspirations. They found that value for social status in work mediated the relationship between students' social status and their career aspirations. Further, they found that conformity to feminine norms moderated the relationship between status and value for status in work, such that the relationship between social status and the value for status at work was stronger for those with lower conformity to feminine norms. This study uses the compatibility test to show that, if participants had a value image consistent with gender norms, they were more likely to value status at work consistent with that image.

Images in Occupational Choice

The inclusion of images in occupations is not new. Gottfredson (1981) theorized that occupational choices are made based on a self-concept developmental process. In her theory of “circumscription and compromise,” Gottfredson proposed that individuals identify potential occupations based on the combination of interests, self-concept, and occupational images. Self-concept is how a person views him- or herself based on internal and external information (Marsh, 1990). It is “the totality of different ways of seeing oneself” (Gottfredson, 1981, p.547).

Gottfredson (1981) considered self-concept development as a progression of abstractness in thought processes, beginning in early childhood and ending in early adulthood. In early childhood, the least abstract stage, the child develops an image of occupations as adult roles. Then, as the child becomes more aware of genders, he or she develops a sense of what Gottfredson called ‘sextypes’ in occupations: an eight year old is able to differentiate between stereotypically feminine and masculine occupations, such as a nurse or a kindergarten teacher compared with a fire fighter or a construction worker. Between the ages of nine and thirteen, pre-teens’ thought processes become less concrete as they begin to develop a sense of social valuation. They begin to associate different levels of effort and ability with different occupations. As they rely less on concrete observations and become able to make abstract connections, children in this stage associate different levels of prestige and social class to occupations. Self-concept is further refined during this stage as the pre-teen matches his or her abilities and social class to possible occupations. Gottfredson’s view of self-concept development is consistent with the development of value images in image theory.

Because the proposed study specifically focuses on academic major choice, the last stage of Gottfredson's (1981) theory is most relevant. She hypothesized that young adults are able to make complex associations and begin to integrate interests, values, and abilities, into concepts of occupations and specific areas of work. They consider occupations and alternatives. They also identify the knowledge, skills, and training needed for their areas of interest. In short, they develop an awareness of their occupational choices and the individual differences, such as ability and traits, associated with these careers. This stage resembles the scanning process during the compatibility test in image theory, when the person identifies possible occupations that are consistent with the person's self-concept. According to Gottfredson, this stage is also when young adults become aware of the hurdles, obstacles and challenges associated with various vocations including required training or education, geographic availability, or simply accessibility of a position. This awareness also parallels the decision process with the profitability test in image theory, when the individual incorporates external factors into the decision-making process and directly compares options. In short, young adults begin to integrate occupational images with their self-concept, which is the totality of how they view themselves based on internal and external information (Super, 1953). Adolescents and young adults begin to balance their interests with perceptions of opportunity, accessibility, and availability of work. According to Gottfredson, individuals compromise occupational compatibility during this stage. She suggested that compromise occurs more readily in areas less central to one's self-concept. For example, if economic status is central to David's self concept and he has a moderate level of interest in investigative

occupations, he will be more likely to take a higher paying position in a non-investigative field than a lower paying option more in-line with his interests.

To sum, Gottfredson (1981) introduced the notion of images in occupations that parallel the value, trajectory, and strategic images that define an individual's values, goals, and plans in image theory. She defined occupational images as the commonly held perceptions of various occupations, including the characteristics of people in those occupations, the nature of their work, and the risks and rewards associated with them. Similar images of occupations are held across age, gender, and social class. According to Gottfredson, these mental models are the basis for a shared understanding of the individual, social, and fiscal aspects of any particular vocation. Similar to the process of using a profitability test, Gottfredson argued that people combine elements of self-concept, such as gender and interests, with occupational images, such as attractiveness and prestige, to identify career options.

Image Theory as Vocational Fit

I propose that image theory is an integrated theory of fit – a theory that combines elements of congruence with self-concept development and decision-making. I suggest that people adjust the choices related to their career paths as their images become clearer and their professional self-concepts develop. In this interpretation of image theory, the compatibility with the image is operationalized with the objective fit between the person's interests (i.e., Holland code) and the classification of the vocational environment, and the individual's adjustments are made primarily through a better understanding of the vocational environment.

In an academic context, the vocational decisions refer to students' choice of academic majors and then occupations. Students enter college with more or less of an image of what they want to study and how their studies may (or may not) influence their future occupational choices. I think that the undergraduate student population offers a unique opportunity to investigate this interpretation of image theory because students make several vocational choices in a relatively short period of time. Images are refined and clarified as the students acquire additional information through the course of their academic tenure. The following, along with Figure 4, is a description of the decision process as implied by image theory.

Value Images

Image theory suggests that individuals make career decisions that are “consistent with the way they see themselves and their futures” (Stevens, 1996, p. 52). Value images are the basis for candidate goals and plans (Beach & Mitchell, 1996). Applied to an academic context, students enter college with an initial preference for areas of study based on an image of what those majors entail (Figure 4). This image varies in clarity. A student with low image clarity will scan through a larger set of options when selecting his or her academic major compared with a peer who is certain she wants to major in Biology. Students' value images are a reflection of how they see themselves, academically, when they first begin their undergraduate careers.

Initial value images, or occupational self-concepts, will be influenced by childhood perceptions of occupations (Gottfredson, 1981; Super, 1953) and parents (Stevens, 1996, 1998). There is a growing trend of parents overly engaged in their adult children's lives, including the child's choice of major and occupation (Kenny, 1990).

Trajectory Images

In this application of image theory, the trajectory image, or goal, is identified through a compatibility process (Figure 4). Students' images evolve with knowledge gained from college and course experiences, they adapt their decisions until they select a major. The trajectory image is consistent with the value image and narrows the field of academic options under consideration. It is a "central, defining decision that substantially affects many other future goals" (Stevens, 1996, p. 53). As students' images evolve with knowledge gained from college and course experiences, so does their perceived compatibility with their major. Students refine their academic self-concept as they integrate information about academic majors and receive feedback regarding their performance. In other words, a student will experience image confirmation if they are performing well, or image violation if they are performing poorly, in major-related courses.

The literature on goal-selection emphasizes the role of self-efficacy (Bandura, 1997), particularly as it relates to careers and occupations (Betz, 2007; Hackett & Betz, 1981; Lent, Brown, & Hackett, 1994). Self-efficacy is the person's confidence in his or her ability to accomplish a task (Bandura, 1997). Simply stated, an individual is more likely to pursue a goal he or she believes she can achieve. Self-efficacy, together with an interest in an occupation, greatly influences a person's decision to pursue that occupation (Lent, Brown, & Hackett, 1994). For example, if Emily has an interest playing the violin professionally and she believes she is able to accomplish this goal, she is more likely to pursue a career as a violinist in an orchestra than if she lacked the confidence to achieve her goal. In the context of image theory, specifically with selecting a goal, goal-setting

self-efficacy is an indication of image clarity. A student with high goal-selection self-efficacy has a trajectory image more compatible with his or her self-concept, compared with a peer with a similar goal, but with low goal-selection self-efficacy. Therefore, confidence in their ability to select a goal is relevant to students' image when they officially select and commit to a major.

Strategic Images

Most students at Rice University begin to think about their lives after college more concretely around their seventh semester (Rice University Center for Career Development, 2012). Implementing their goals, or developing a plan for their careers after graduation, corresponds to the strategic image in image theory (Stevens, 1996). I suggest that, when considering occupations, students adopt a profitability test to evaluate candidate options. As discussed, the profitability test is influenced by external factors, such as the characteristics of the decision maker and financial considerations (Beach 1990).

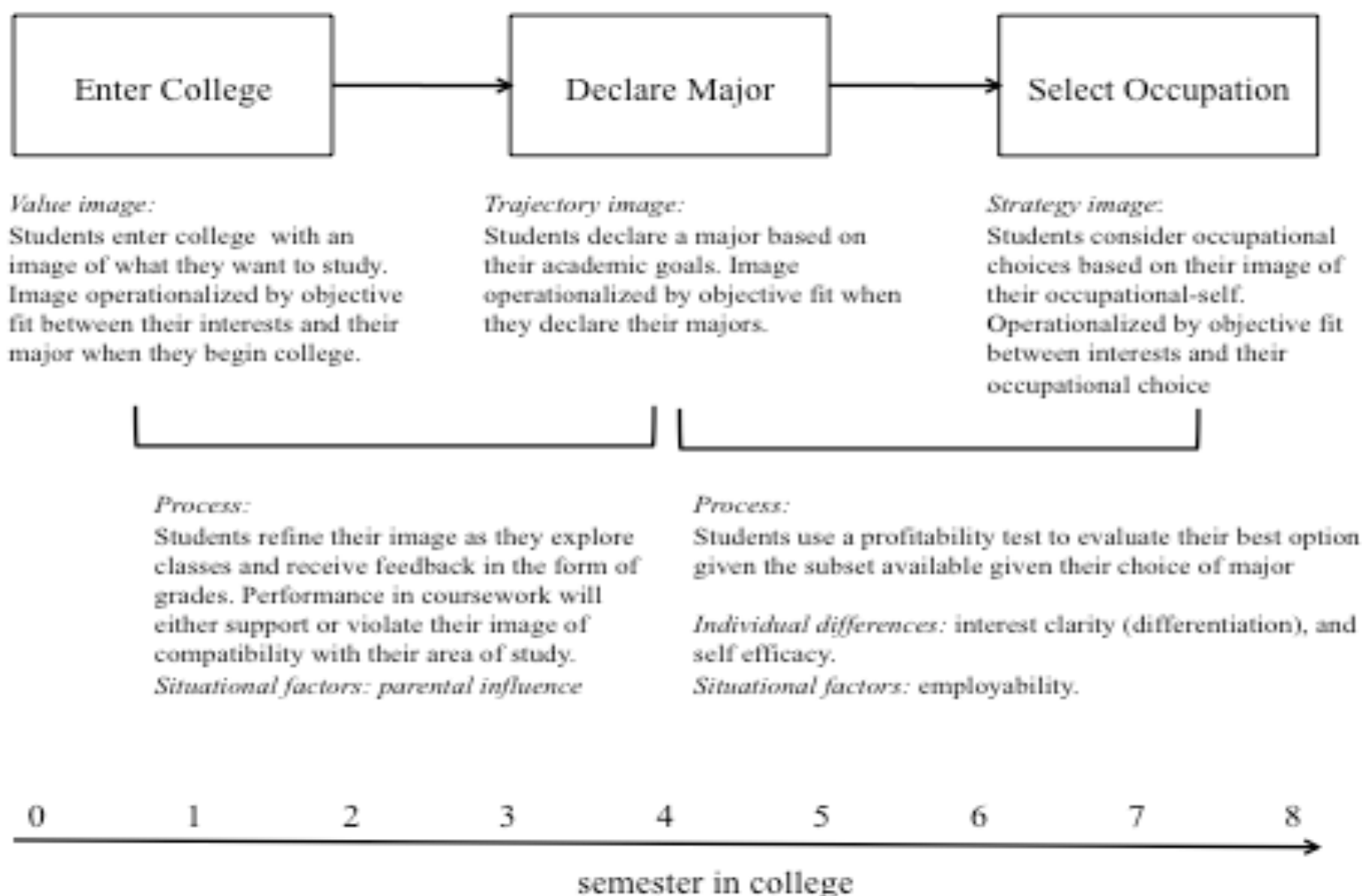
I consider two relevant characteristics of the decision maker that may influence the clarity of the strategic image. The first is the clarity of their interest profiles. Recall that Holland's theory of vocational personalities interprets profile differentiation, or the difference in scores between the highest and lowest interest areas, as an indicator of interest clarity (Holland, 1997). A person with high profile differentiation has more distinct preferences, and therefore a clearer image, than a person with low differentiation. The second factor I consider is the centrality of work is to one's self-concept (Kanungo, 1982). A student who has a high level of work centrality is more likely to incorporate the

required knowledge, skills, and abilities associated with the occupation into his or her self-concept (Gottfredson, 1981).

The hiring landscape is also likely to influence the student when comparing options during the profitability test. Only 55% of young adults between the ages of 16 and 29 are employed (NPR, November, 2011). College graduates today have an expectation of employability but are increasingly concerned about their ability to find work. As graduation approaches, the need for employment is no longer a distal factor; the likelihood of finding a meaningful job or gaining admission to a prestigious graduate program becomes a salient consideration.

In short, I posit that image theory can be applied to students' decision-making process as they manage their academic careers and occupational plans. According to image theory, an individual's ability to make decisions depends on image clarity at each stage (Beach & Mitchell, 1996). Their value images will be influenced by their childhood experiences and the influence their parents have on their self-concept. During the first academic semesters, students rely on their interests and external feedback in the form of performance to narrow options for academic majors, until they select their goal. Their trajectory image, or goal, is influenced by their confidence in their ability to select the goal. Then, their strategic image, or plan, reflects their transition from an academic major to an occupation; the strategic image is influenced by the clarity of person's interests, the centrality of work to their self-concept and employment potential.

Figure 4. Image Theory Model of Academic Major and Occupation Choices



CHAPTER 3: PILOT STUDY

The current investigation is informed by results from an exploratory study conducted in Spring 2009 at Rice University. Seniors and sophomores were recruited through targeted class-level emails. Approximately the same number of people participated from each class (194 seniors, 199 sophomores). Participants were 42% male, 57% white, from 37 majors. The highest number of participants majored in Biochemistry and Cell Biology (9%), Psychology (7%), and Mechanical Engineering (6.6%). Respondents were asked to think retrospectively about their major choices: their intended major when they enrolled, their declared major, and, for seniors, their current major.

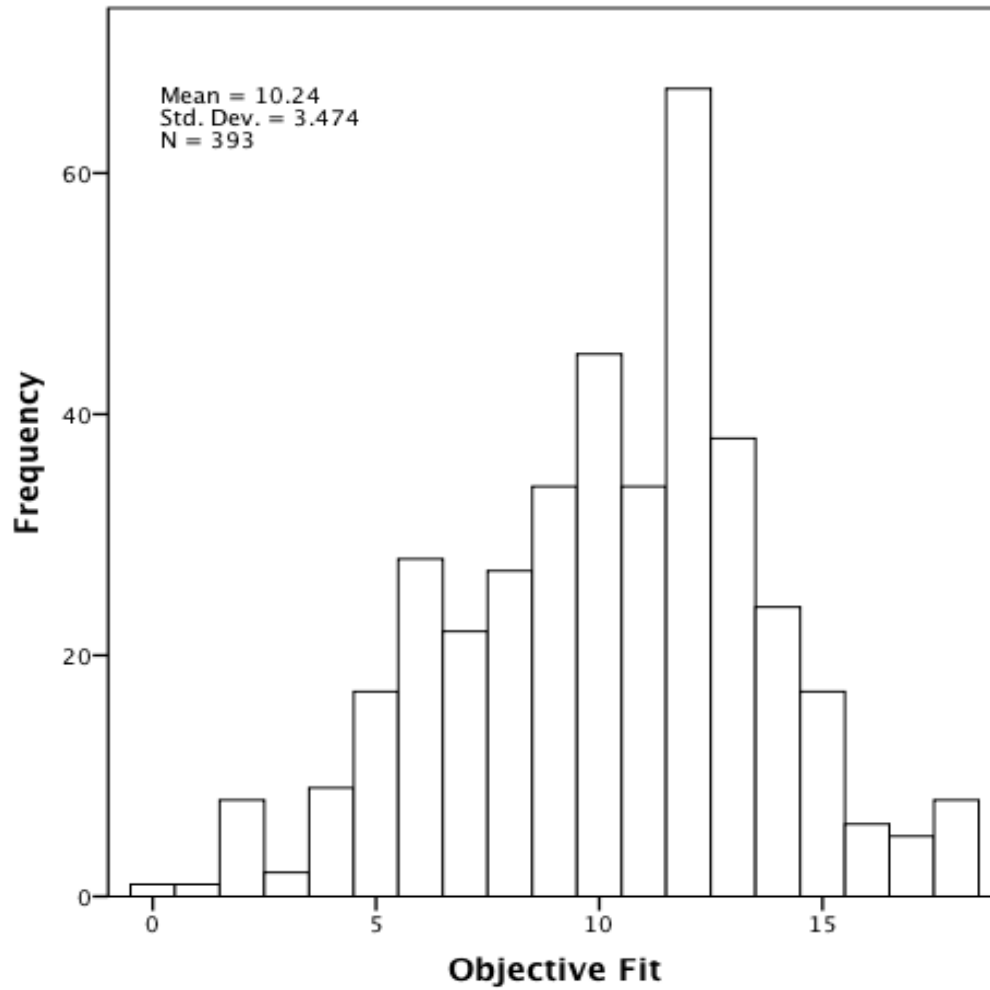
Consistent with reports at other institutions (Feldman, Smart, & Ethington, 1999), roughly 48% of students indicated that they changed their intended major. Only 3% of the seniors indicated a change in major after their sophomore year, suggesting that academic major choice is relatively stable after the official decision and declaration during their second year. Only one student of the 393 respondents expressed difficulty in specifying a primary major.

A public domain measure of interests (Armstrong, Allison & Rounds, 2008) was used to assess participants' Holland codes. Using the Dictionary of Holland Occupational Codes for college majors, a measure of objective fit was calculated. I used Brown and Gore's (1994) congruence index, or C-index, which is a weighting scheme based on a rank-order comparison of the person's highest three areas of interest and the major's classification. The result is a fit score ranging from 0 – 18, where zero is a major choice completely incongruent with interests, and 18 is a perfect match

between interest profile and academic major code. For example, if Sally's interest profile is ASE, and her major profile is AIE, then the C-index is 3 for the perfect match for the first letter in the code, 1 for the second letter, because S is two points away from I along the hexagon (see Figure 1), and 3 for the match of the last letter of the code. Then, the numbers are weighted according to position in the code such that the first letter is weighted by a factor of three and the second letter is weighted by a factor of two. So, Sally's C-index is 14. Studies comparing various indices that compare Holland codes have shown the C-index to be a better predictor of outcomes than other comparable indices (Hoeglund & Hansen, 1999). Figure 5 shows the distribution of objective fit scores. This histogram illustrates that students vary in the fit between their interests and their major. The near-normal distribution shows that there is sufficient variance in objective fit between students to support a study that investigates the different career decisions students make.

Approximately one quarter (24%) of those surveyed showed a change in objective fit between their first and fourth semesters. Of those who showed a change in fit, only half made decisions that improved their fit with their major. Therefore, I suggest that there may be within-person variability in fit as students make these career decisions that can inform the study of occupational choice.

Figure 5. Distribution of objective fit with academic major in the pilot study. Objective fit is computed using Brown and Gore's (1994) C-index. The scale has a range of 0 – 18, where 18 represents the student with a major that matches his or her Holland code exactly, and 0 is the case where the student does not share *any* interests with his or her major.



CHAPTER 4: THE CURRENT INVESTIGATION

In this study, I considered two key career decisions made by undergraduates: their choice of academic major and their post-graduation occupational plans. I took a within-person approach to examining fit during their academic careers. Then, I evaluated how individual differences and relevant situational factors influenced the relationship between fit with major and fit with career choice after graduation.

Recall that objective fit is the congruence between a person's interests and his or her occupational environment. When students are in their first two years of college, their academic major best represents the environment. As they approach graduation, their planned occupations best represent the environment. I examined fit by asking students in their final year to report, retrospectively, the majors they considered during their academic tenure. Then, I asked them about their planned occupations after graduation. Participants also completed a series of inventories, including an assessment of interests, which was used to derive their Holland codes (three letter codes) and interest profiles (six letter codes). For the categorization of occupational environments, I used publicly available information to classify both the academic major and the occupational choice. I made the assumption that interests are dispositional and that they are relatively stable. Recent studies of interests in young adults and across demographic groups support this assumption (Low et al., 2005; Tracey & Robbins, 2005).

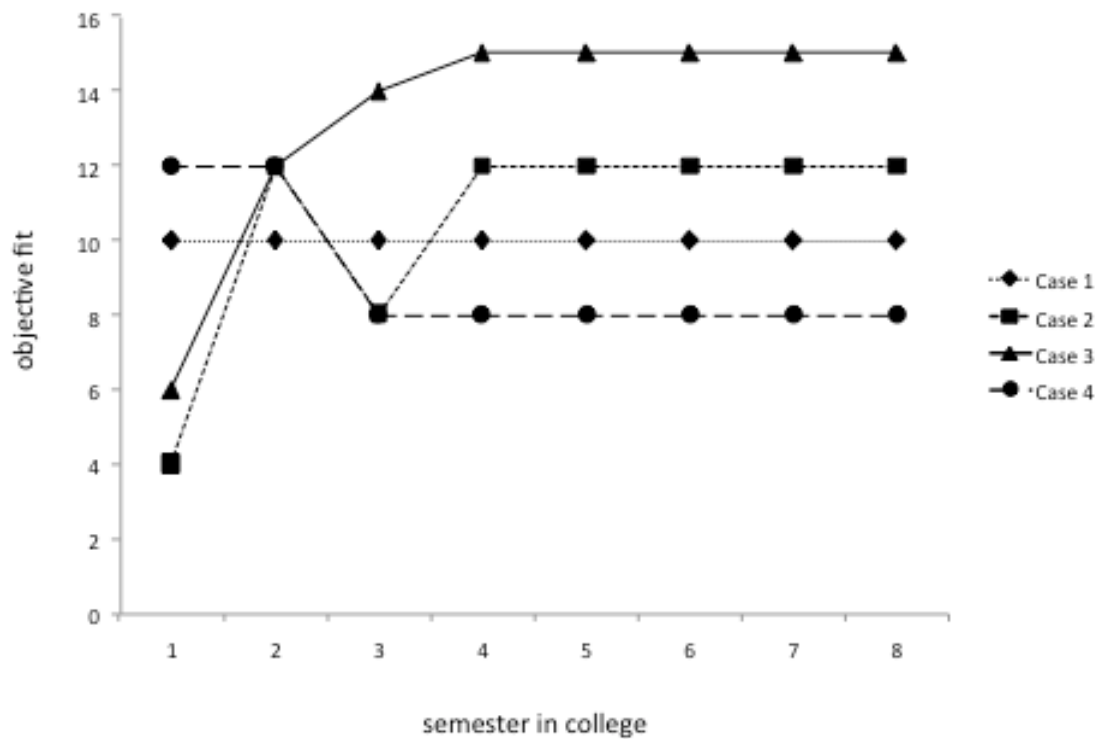
In contrast to the stability of interests, it is common, almost expected, that college students change their choice of major (Barak & Rabbi, 1982). It is not unusual for students to consider a variety of options before committing to an area of study, typically at the end of their second year. It is this change in major choice that provides

the potential for change in fit in this study. Figure 6 shows examples of different objective fit trajectories or objective fit at different points in a four-year education. The first case is the example of a student who enters college intending on a major that moderately fits his or her interests, and who does not change that major. Case 2 shows a student who enters college planning on a major that does not fit with his interests. As he experiences different classes, he considers a different major that is more compatible with his interests at the end of his freshman year. In the middle of his sophomore year, he considers an option that is more similar to his first choice, and then reconsiders again at the end of his sophomore year. The third case is the case that best represents what image theory predicts: a student enters college with an image of which major best represents her interests, and then refines that choice to improve her fit as she experiences courses in her major. The fourth case is the student who enters college with an intended major that is a moderately high fit with his interests. Then, reconsiders at the end of his freshman year and opts for a major that is a worse fit, and maintains that decision until graduation. Based on the results of the pilot study, all four of these examples show students maintaining fit after their majors are declared at the end of their fourth semester.

Because of the design of this study, the only way a student's fit can change is when there is a change in major. But, a change in major does not dictate a change in fit. Consider in this study, Matthew, who has a Holland code of IRC and changes his major from applied mathematics to mechanical engineering. A study of major change would interpret Matthew's decision to be a change in occupational choice. However, because both applied mathematics and mechanical engineering share the same profile of IRC, a

study that focuses on changes in fit would not view this decision as a change in Matthew's profile. In other words, Matthew's decision remains consistent with his interests, and his objective fit does not change.

Figure 6. Sample of objective fit trajectories. Students will vary in their objective fit primarily during their first four semesters in college as they consider different options. A student may not change his or her major at all (Case 1, diamonds and dotted line), may steadily improve their fit with their major (Case 3, triangles and solid line), or may decrease their fit (Case 4, circles and long-dashed line). Students rarely make a change once they officially declare a major.



As described in Figure 4, image theory offers a model relevant to career decisions during early adulthood when 18 – 22 year olds are making education and early career choices based on images of occupations, academic training, and very limited experience (Gottfredson, 1981). Students use a compatibility test as they consider their academic major options. Then, they weigh their post-graduate opportunities given the academic choices they made. Students adopt a profitability test or strategy when making their post-graduate plans.

Most longitudinal studies of occupational fit, particularly as it relates to academic majors, have evaluated the continuity of interests (Gottfredson, 1977; Low et al., 2005), the persistence in an academic major or occupation (Allen & Robbins, 2008; Feldman et al., 1999; Holland & Nichols, 1964; Nauta & Epperson, 2003), or how predictive interests are of relevant outcomes, such as performance (Schmitt et al., 2008; Tracey & Robbins, 2006). A few multi-level studies have considered different levels of analysis, such as the difference between institutions (Tracey & Robbins, 2006) or occupations (Ishitani, 2010). To the best of my knowledge, based on a review of the literature, this study is unique in its consideration of fit profile and in its within-person design. In this investigation, objective fit and the stability of objective fit are dependent variables.

Fit with Academic Major

Image theory suggests that, as students progress from value images to goal/trajectory images, they will select majors that are more compatible with their interests. As they gain experience in and knowledge of their area of study, students will confirm or alter their choice of academic major to better fit their self-concept.

H1: Students will change their major during academic tenure to improve their objective fit.

Recall that parental influence is a situational factor that influences a student's occupational images beginning with childhood (Gottfredson, 1981; Super, 1953). Even though parental support is being assessed at a single point in time, self-concept development suggests that the influence exists from early stages of image formation. I hypothesized that students with higher levels of parental influence would have narrower, clearer occupational images and would therefore demonstrate less variability in objective fit with academic major during the first four semesters. In short, I expected students would seek to maintain consistency with stronger images.

H2: Parental influence will be positively related to stability in objective fit; students with more influential parents are less likely to significantly vary their choice of academic major.

Fit with Occupation

As previously discussed, the transition from fit with academic major and fit with occupational choice corresponds to the transition from goal/trajectory to plan/strategic images in image theory. Students adopt a profitability test, during which they directly compare candidate options and select an occupation (refer to process described in Figure 4). Academic majors tend to be more general classifications of the environment than occupations (Tracey, 2007). Therefore, I hypothesized that, with all else being equal, students would further refine their choices by directly comparing occupational choices as they seek a consistent or better fit with their interests. The relationship between academic major fit and occupational fit would remain constant or increase.

H3: Objective fit with occupation will be consistent with objective fit with major. So, objective fit with major will remain the same or will improve when compared with objective fit with occupation.

Referring to the decision-making process described in Figure 3, the profitability test is influenced by factors that include attributes of the decision maker and salient environmental considerations (Beach, 1990). Here, I considered four factors that are relevant to the current study. Goal-selection self-efficacy, differentiation, and career centrality are characteristics of the decision-maker that would influence the decision-making process and the clarity of the individual's images. When considering occupational choices, employability, or the likelihood of being finding employment, is a relevant situational factor that is particularly salient for college seniors (NPR, November, 2011).

If students have a high level of confidence in their ability to select their goal, then they are more confident in their choice of major and their choice of occupation (Betz & Taylor, 2012) and will hold clearer images of both. Therefore, I expected that there would be a main effect of self-efficacy; students with higher goal-selection self-efficacy would tend to have better objective fit when they declared their majors and when they selected their occupations than their peers with lower goal-selection self-efficacy.

H4: Students higher goal-selection self-efficacy will tend to have higher objective fit with both academic major and occupation than students with lower goal-selection self-efficacy.

Students with more differentiated profiles have clearer sets of interests, are more likely to have selected majors with which they are compatible, and are less likely to consider occupational options outside their more narrowly defined plan images. Therefore, I expected that students high in differentiation would be less likely to change their objective fit between their academic major and their occupational choice. By comparison, students with low interest differentiation would be more likely to consider a wider array of possibilities because their images are not as clear. These students would be more likely to improve their objective fit when they select their occupations because they are choosing an occupation from a larger pool of candidate options.

H5: Students with higher differentiation will be less likely to change their choice of major and therefore have a more stable fit profile, whereas students with lower interest profile differentiation will likely improve their objective fit when they select their occupation.

Work centrality is “the degree of importance that work, in general, plays in one’s life” (Paullay, Alliger, & Stone-Romero, 1994, p.224). Students high in work centrality are more likely to have considered the application of their major to occupations. In image theory terms, these students have goal images more closely related to their plan images. Therefore, they consider a narrower set of options when selecting an occupation. I expected students high in work centrality to have a more consistent and higher objective fit. I also expected that students who are lower in work centrality would be likely improve their fit as they refine their plan images when making occupational choices.

H6: There will be a main effect of work centrality. Students high in work centrality will tend to have higher objective fit with their major and occupational choices than students with lower work centrality. There will also be an interaction between vocational environment and work centrality. Students low in work centrality will improve their objective fit as they consider occupational choices that are more consistent with their strategic images.

Lastly, as students consider their occupational choices for life after college, the employment potential associated with their academic majors becomes more salient. I expected that some students would sacrifice fit when making a career decision for the sake of employment. As Gottfredson (1981) suggests, people are more likely to make a compromise or sacrifice elements that are less central to their self-concept. Therefore, I expected there would be an interaction between employability and work centrality. Students with high work centrality would be more likely to have considered employability as part of their image and would be less likely to be affected by employability concerns; so the objective fit for students with high work centrality would not change with employability. Students with low work centrality, on the other hand, would be more likely to be influenced by employability concerns, and would sacrifice fit for the sake of an occupation with a higher potential for employment.

H7: Work centrality will moderate the relationship between the potential for employability and occupational fit. Students with high work centrality are less likely to alter their occupational choices for the sake of employability, whereas students with low work centrality will sacrifice occupational fit for the sake of higher employability.

CHAPTER 5: METHOD

Participants

I recruited 259 of approximately 750 students (a 35% response rate) in their final year at Rice University for this study. Students from the schools of Humanities, Social Sciences, and Natural Sciences were invited to participate through a targeted, individualized email. Participants were compensated \$20 for their time after completing an online questionnaire and releasing access to their academic transcripts. The participants were roughly representative of the overall population at Rice University. As shown in Table 2, students in the Natural Sciences were slightly under-sampled and students in the Social Sciences were slightly over-sampled. Participants were 60% women, 42% Caucasian, 33% Asian, 12% Hispanic, and 6% African American.

Participation was limited to students graduating during the current academic year because professional life after college is more salient when students are closer to graduation. Three percent of respondents expected to graduate in December 2012. The majority of participants expected to graduate in May 2013. Two participants were dropped from the sample because their interest profiles were completely flat; these students expressed an interest in all activities in the interest inventory. Therefore, it was not possible to calculate objective fit for these two cases.

Table 2: Representativeness of participants across academic disciplines.

School	Study (%)	University (%)
Humanities	19.3	19.2
Social Sciences	34.4	25.7
Natural Sciences	17.8	21.6
Engineering	28.6	28.9

Note: University percentages do not add up to 100% because they include students in Architecture and Music.

Design and Procedure

Graduating seniors in the Humanities, Social Sciences, Natural Sciences, and Engineering received an email inviting them to participate in a study of academic major and occupational choices. The invitation specified that they could earn \$20 for their participation when they completed the survey and signed a transcript release form that would grant the researchers access to their official university transcripts. As an added incentive for participation, students were told that participation would automatically enter them into a lottery for two \$250 gift cards. Students who responded within the first 10 days of the study doubled their chances in the lottery.

After giving their consent, participants were asked to report, retrospectively, what they considered their primary area of study at six different times during their academic tenure: when they first enrolled in college, at the end of each of their first, second, third, and fourth semesters, and what their current primary major is. Students were also asked if they had other majors in addition to their primary area of study.

Next, students were asked to describe their career aspirations after graduation in as much specificity as possible. For students planning on graduate school after graduation, they were asked what their target occupation is after graduate school. For example, a student planning on medical school might specify pediatrics as his or her planned occupation. They were also asked to rate their target occupation for relatedness to their primary major (5-point scale from not at all related to extremely related), their confidence in their ability to find work in their chosen occupation (5-point scale from no confidence at all to complete confidence), and their perception of how available jobs are in that occupation (5-point scale from not at all available to very available).

Students were asked to respond to a series of measures to assess their interests, their goal-selection self-efficacy, the degree to which their parents influence their choices, their satisfaction with their primary major and their perception with how well they fit with their major, the importance of work in one's life, and basic demographic information. Objective fit and interest profile differentiation were derived from the students' responses on the interest measure.

Measures

Interests and Holland codes. ACT's measure (UNIACT-S) was used to measure students' interests. This 72-item instrument has been validated with large samples of young adults (Tracey & Robbins, 2006) and has been mapped to Holland's hexagon (Prediger, 1981, 1982). Items focus on activities and avoid occupational titles (ACT, 2009). For example, rather than asking about interest in becoming a biologist, the UNIACT asks about interest in using a microscope and other lab equipment. This inventory has shown interests in teenagers and young adults to be stable over time

(Tracey, Robbins, & Hofsess, 2005), and gender and race (Tracey & Robbins, 2005). Each of the six interests types (RIASEC) is measured through 12 items. Participants rated their level of interest on a 5-point Likert scale, ranging from 1 (not at all interested) to 5 (extremely interested) for each of the 72 items. Reliability estimates were .87, .90, .86, .79, .81, .90 for Realistic, Investigative, Artistic, Social, Enterprising, and Conventional interests, respectively. Following ACT's scoring instructions, the response for each item was converted to a 3-point scale, and the scores for the 12 items in each of the interest area were averaged to obtain a raw score for that area. Raw scores were then used to obtain standardized scores ($M=50$, $SD=10$; ACT, 2009) in each of the six interest categories (RIASEC). Higher scores indicate a higher level of interest in that area. All six areas of interest were ranked for each student and the highest three provided the participant's Holland code. Ties in score for the highest three areas of interest were broken by referring back to the raw scores. In cases where both the standardized and raw scores were tied, the tie was broken randomly.

Satisfaction with major. On a six-item measure of satisfaction with academic major (Nauta, 2007), participants rated the accuracy of each item on a 7-point Likert scale, ranging from 1 (very inaccurate) to 7 (very accurate). Reliability estimate for this measure (Cronbach's α) was .89. Example items include "Overall, I am happy with the major I selected," and "I feel like I considered all my options before selecting this major." Higher scores reflect a higher level of satisfaction.

Perceived fit. Schmitt and colleagues' (2008) measure of perceived fit with major was used. Participants rated their agreement to each of the six items of this scale using a 7-point Likert scale, ranging from 1 (strongly disagree) to 7 (strongly agree).

The reliability estimate for this measure (Cronbach's α) was .78. A higher score indicates that the student perceives a higher level of fit with his or her academic major. Participants with more than one major will rate perceived fit with each major, separately.

Work centrality. Students completed Paullay et al.'s (1994) 12-item measure of work centrality by rating their agreement with each item on a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The reliability estimate (Cronbach's α) for this measure was .86. A lower score indicates that the student has a lower level of work centrality.

Goal-selection self-efficacy. The goal-selection self-efficacy scale is a 10-item scale developed by Betz and colleagues as part of the career decision self-efficacy measure (Betz & Taylor, 2012). Participants rated their level of confidence in their ability to select career goals on a 5-point Likert scale, where 1 was "no confidence at all" and 5 was "complete confidence." Sample items include "select one major from a list of potential majors you are considering" and "select one occupation from a list of potential occupations you are considering." The reliability estimate (Cronbach's α) for this scale was .70.

Parental influence. Kenny (1990) developed a measure of parental influence, defined by the degree to which the parent facilitates the child's independence. This scale is comprised of seven items that reflect parental support, and seven that reflect parental control, as a negative influence. Participants rated the accuracy of 14 items on a Likert scale, ranging from 1 (very inaccurate) to 7 (very accurate). The reliability was estimated for the support component, the control component, as well as the overall

scale, with control items reverse scored; Cronbach's α was .90, .78, and .89 respectively.

Demographic info. Students also provided demographic information, including race, occupation of parents, and annual household income of primary household.

Derived Variables

Coding of academic major and occupations. Academic majors were categorized based on two well-established classification systems: Holland code and the World of Work Map (WWM). The National Center for Education Statistics' Classification of Instructional Programs (CIP; nces.ed.gov/pubs2002/cip2000) served as the basis for deriving the Holland code for each major.

The World of Work Map uses Prediger's (1981) conversion of Holland's RIASEC into a two-dimensional Data/Ideas, People/Things classification of occupations. ACT has published RIASEC scores for 20 CIP codes (Allen & Robbins, 2010), as well as a complete mapping of all possible three-letter code combinations to the twelve regions of the WWM (see Figure 2; ACT, 2009). Both the RIASEC scores and the WWM region are used to classify academic major for purposes of calculating objective fit. If mean scores for the RIASEC were not available in Robbins and Allen (2010), I matched the CIP code to the O*NET code using the publicly available "crosswalk" on the NCES website. Then, I used the Holland code listed in O*NET.

Table 3 lists the CIP code, Holland code, and WWM region for each major at Rice University. Holland codes for occupations were taken directly from O*NET.

Table 3: Classification of majors.

Major	CIP family	Holland code	WWM region
Ancient Mediterranean Civilizations	30	IAE	9
Anthropology	45	IAS	10
Architecture	04	AIE	10
Art History	50	AIR	9
Asian Studies	05	SIA	11
Astrophysics	40	IAR	9
Biochemistry & Cell Biology	26	ISR	9
Bioengineering	14	ICR	7
Biosciences	26	ISR	9
Computational and Applied Mathematics	27	IRC	7
Chemical Engineering	14	ICE	7
Chemistry	40	ISC	9
Civil Engineering	14	RIC	7
Classical Studies	30	IAE	9
Computer Science	11	IRC	7
Cognitive Sciences	42	ISA	10
Environmental Biology	26	ISR	9
Economics	45	ESC	2
Electrical Engineering	14	IRC	7
English	23	SAI	11
Environmental Engineering Sciences	14	IRC	7
Environmental Sciences	26	ISR	9
French Studies	05	SAI	11
German Studies	05	SAI	11
Hispanic Studies	05	SAI	11
History	54	EAI	1
Kinesiology	31	SIC	12
Linguistics	16	IAS	10
Managerial Studies	52	CES	3
Mathematics	27	ICA	8
Mechanical Engineering	14	IRC	7
Medieval Studies	30	IAE	9
Material Sciences & Engineering	14	IRC	7
Mathematical Economic Analysis	45	ICE	7
Philosophy	38	SAI	11
Physics	40	ISC	9
Political Science	45	ESC	2
Policy Studies	44	ESC	2
Psychology	42	ISE	10
Religious Studies	38	SIA	11
Sport Management	31	SIE	12
Sociology	45	SEI	1

Major	CIP family	Holland code	WWM region
Statistics	27	CIR	6
Study of Women, Gender & Sexuality	05	SAI	11
Visual and Dramatic Arts	50	ASE	12

Note: CIP family refers to the classification of instructional programs by the National Center for Education Statistics (NCES). The Holland code refers to the highest three areas of the hexagon that describe the major: Realistics, Investigative, Artistic, Social, Enterprising, and Conventional (see Table 1 for detailed descriptions). The WWM region references the section of the World of Work Map corresponding to the Holland code (see Figure 2 for illustration of WWM).

Differentiation. Differentiation is a calculated field that reflects the clarity of the person's interests (Holland, 1997). It is the difference between the highest scoring interest, and the lowest scoring interest. A large difference reflects a higher clarity and, therefore, a more differentiated profile. For example, if a student's highest interest area was Artistic, with a score of 65, and a lowest interest area of Conventional, with a score of 40, then the interest profile differentiation is 25.

Objective fit. Four measures of objective fit were calculated, two of which were based on the Holland code, or highest-ranking three areas of interest. The other two measures of objective fit were calculated using the full interest profile (all 6 areas of interest).

C-index. Developed by Brown and Gore (1994), the C-index is a weighting scheme based on a rank-order comparison of the person's highest three areas of interest and the major's classification. The result is a fit score ranging from 0-18, where zero is a major choice completely incongruent with interests, and 18 is a perfect match between interest profile and academic major code. For example, if Sally's interest profile is ASE, and her major profile is AIE, then the C-index is 3 for the perfect match

for the first letter in the code, 1 for the second letter, because S is two points away from I along the hexagon (see Figure 1), and 3 for the match of the last letter of the code. Then, the numbers are weighted according to position in the code such that the first letter is weighted by a factor of three and the second letter is weighted by a factor of two. So, Sally's C-index is 14.

WWM fit. I used a comparison of WWM regions of the person's interests and the environmental classification. Using the previous example, Sally's Holland code places her in region 12 of the WWM (ACT, 2009; Figure 2). Her major, AIE falls, in region 10. ACT (1995) has identified an indicator of congruence ranging from zero to six based on regions of the WWM (Figure 2), where 0 is least congruent when the individual's profile and the major profile are in opposite sections and 6 indicates that both individual and major profiles are in the same section. In Sally's case, her congruence rating is 4.

Profile correlation. I computed the correlation coefficient using the student's RIASEC scores and the corresponding scores for the major (Allen & Robbins, 2010). A significant limitation to this whole-profile calculation is the availability of whole-profile classification of majors. This portion of the analysis is limited to majors with CIP codes with available full-profile RIASEC scores. This limitation brings the sample size down from 257 to 164 for analyses including the profile correlation calculation.

Euclidean distance. ACT uses their large sample to determine the RIASEC mean scores for each academic major. ACT researchers are then able to place the academic major in the WWM (e.g., Tracey, Allen, & Robbins, 2012; Tracey & Robbins, 2006). Euclidean distance is the distance between the location of the person's

interests in the two-dimensional space (things/people vs. data/ideas) and that of the major in the same space. To obtain the Euclidean Distance, first RIASEC scores are transformed into things/people, data/ideas as follows (Prediger, 1981):

$$T/P = 2*R + I - A - 2*S - E + C, \text{ and}$$

$$D/I = 1.73*E + 1.73*C - 1.73*I - 1.73*A$$

Then, the distance is,

$$\text{Distance} = \sqrt{(TP_{\text{major}} - TP_{\text{student}})^2 + (DI_{\text{major}} - DI_{\text{student}})^2}$$

Comparison and use of measures of fit. As summarized in Table 4, each of the four measures has its advantages and drawbacks. Availability of accurate classification of the environment is a significant consideration. In this study, I am able to use all four measures are used in evaluation of stability of fit because of the limited availability of RIASEC scores for majors. However, this level of detail is not available for occupations. As a result, elements of this study related to a comparison between academic and occupational environments are limited to the two measures of fit that rely only on the Holland code. The C-index and WWM fit use the first three letters of the students' interest profiles and the major classification. The profile correlation and Euclidean distance were more detailed calculations, using scores from the full interest profile.

Stability. I computed an indicator of stability of objective fit for each type of the objective fit described above by computing a least-squares fit using the first five measures of fit during a student's academic tenure: fit when enrolled, and fit at the end the first four semesters. A stable fit trajectory is one with little variability from the best-fit line (least squares) through the five points of the objective fit profile. Figure 7

illustrates two cases with the same best-fit line. In the first case, the student has a lower level of variability from the best-fit line. In the second case, the student's changes in objective fit are greater; therefore, this student has a lower level of stability. A high value reflects a high amount of variability and therefore corresponds to low stability of fit. Based on this definition, a person can have a high overall fit, but one with low stability. And, a student could have an overall lower level of fit but a highly stable one.

Employment growth potential. The O*NET database includes an indicator of projected growth for each occupation on a scale of -1 to 4, where -1 is a decrease in growth for that occupation, 1 is less than 10% and 4 is more than 29%. Using O*NET, an estimate of growth in employment was used for each student's planned occupation.

Figure 7. Example of different levels of stability in objective fit. The solid line is the least squares line for both cases. Both students are improving the objective fit between their interests and their academic major. In the first case, the student is varying less from the objective fit trajectory than the second case.

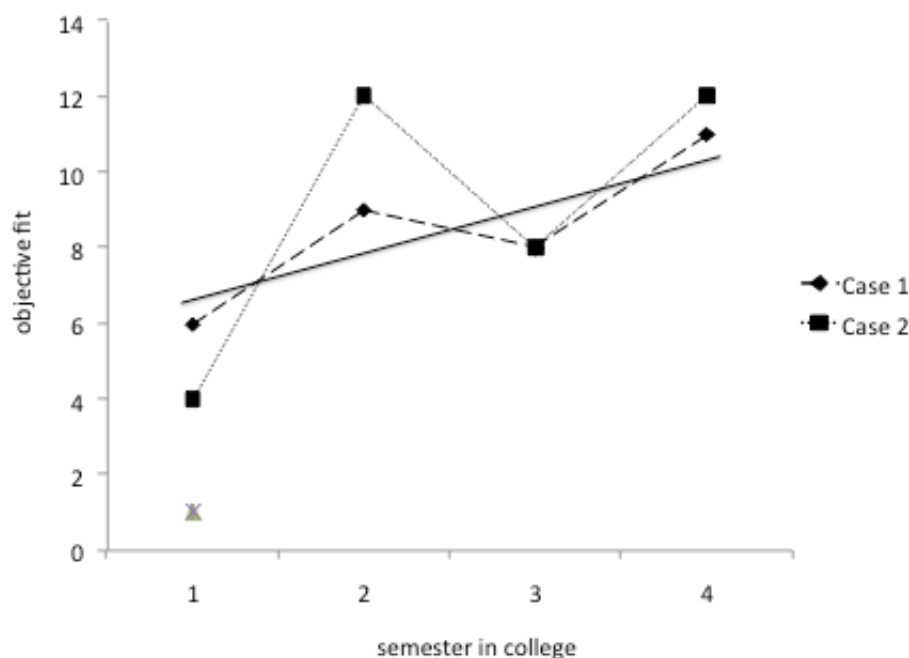


Table 4: Comparison of measures of objective fit.

Measure	Description	Advantage	Drawback
C-index	Compares individual's Holland code to that of the major or occupation; scores range from 0 – 18. Weighting scheme that emphasizes similarity in interest classification as well rank order.	Does not rely on proprietary information; range of possible scores allows for better analysis of variance.	Weighting scheme emphasizes order of Holland code, which can be problematic when the environment is broadly defined, as it often is in vocational studies.
WWM fit	Maps Holland codes to regions in the World of Work map, and provides an index of similarity based on closeness of region. This is a macroscopic interpretation of the Euclidean distance measure (see below). Range of scores is 0 – 6.	Does not rely on proprietary information; more general measure of congruence in that it is less sensitive to the order of interests.	Range of scores is limited, which restricts that amount of variance that can be detected.

Measure	Description	Advantage	Drawback
Profile correlation	Pearson correlation between the individual's RIASEC scores and scores that describe the environment.	Uses the full profile (not limited to highest-scoring three letters); meta-analyses of fit show profile correlations to be most predictive of outcomes (see Arthur et al., 2006).	Relies on proprietary classification of academic majors; full profile scores not available for occupations; not sensitive to score magnitudes.
Euclidean distance	Calculation of the vector difference in things-people/data-ideas space.	Uses the full profile (not limited to highest scoring three letters); predictive of performance and persistence in college. Most specific and accurate of all measures.	Relies on proprietary classification of academic majors; full profile scores not available for occupations; not sensitive to score magnitudes; sensitive to lack of differentiation in environment.

CHAPTER 6: RESULTS

This chapter is divided into three sections. The first section provides an overview of the information collected from participants regarding their career choices. The second section tests proposed hypotheses by reviewing findings from the within-person and between-person analysis of fit, first in the context academic major choices, and then by examining the relationship between academic major and occupational choices. In this second section, all four measures of fit were used in the analysis because RIASEC scores for most of the majors were available. The analysis is restricted to the C-index and World of Work (WWM) measure for the comparison of fit with major and fit with occupation because only 3-letter Holland codes are available for occupations. The third and final section summarizes results from supplemental, exploratory analyses regarding the stability of objective fit.

Overview

The results provide a general picture of the academic and occupational decision-process of college undergraduates. Approximately 60% of respondents changed their intended major from when they entered college. Consistent with the pilot study, only 8% changed their choice after the end of their sophomore year, suggesting that once a student commits to an area of study, they tend to persist in that area. The majority of students maintained or improved their fit with their academic majors between enrolling in college to their senior year: 23% improved their fit while 12% decreased fit. When it came to selecting an occupation, the majority of seniors maintained or improved fit between fit with major and fit with occupation: 28% improved their fit, while 30% selected

occupations that will decrease the fit between their interests and their planned occupational environments. Eighty three percent of participants indicated that their occupational plans were at least somewhat related to their academic majors, suggesting that students tend to follow an occupational path that is related to their primary area of study. A slight majority of participants, 131 students (51%), indicated they plan on entering the workforce. One hundred and six students said they were planning on graduate school. The remaining students expressed a desire to take a 'gap year' prior to pursuing their career goals. For example, a few students are applying for fellowships, such as the Watson, before pursuing longer-term careers goals. For students who plan to take a year or two after college, their ultimate, longer-term objectives were used to define occupational fit.

Students at Rice University are able to select as many as four majors. According to the Registrar reports, approximately 25% of undergraduates have more than one major. In this study, approximately 38% (97 students) of respondents had two majors. Ten students, approximately 4% of the sample, had three majors. None of the participants had four majors. I compared the objective fit of the primary major with that of the second major using a paired *t*-test. There was no significant difference in objective fit between the first and second majors for students with two majors ($t(96) = 1.18, ns$).

Consistent with the literature (e.g., Wessel et al., 2008), objective and perceived fit were unrelated for three of the four measures of fit ($r = .01$, $r = .07$, and $r = .00$ for C-index, WWM, Euclidean distance measures of objective fit, respectively). The profile correlation during senior year was correlated with perceived fit with major ($r = .18, p < .05$). Also consistent with the literature, perceived fit with major is correlated with

measures of efficacy and satisfaction with major ($r = .39, p < .01$ and $r = .69, p < .01$, respectively). Results of this study also indicate a positive relationship between perceived fit and parental influence ($r = .20, p < .01$), which suggests that students who perceive a higher fit with their academic major also tend to have a higher level of support from their parents. Given the inter-correlations between perceived fit, efficacy, and satisfaction with major, it is not surprising that students who expressed higher levels of parental support also reported higher levels of satisfaction with their majors ($r = .14, p < .05$) and a higher level of confidence in their ability to select career goals ($r = .21, p < .01$).

Work centrality, or the importance placed on the role of work in one's life, was unrelated to parental support or either objective or perceived fit with major during senior year. It was, however, correlated with measures of occupational fit ($r = .22, p < .01$; $r = .16, p < .05$ for C-index and WWM fit, respectively), satisfaction with major ($r = .14, p < .05$), and goal selection self-efficacy ($r = .17, p < .01$). This suggests that students with higher work centrality tend to seek occupations that are more aligned with their interests; this relationship is examined more fully during hypothesis testing.

Interestingly, profile differentiation was not correlated with any of the other variables in the study, including measures of objective fit, perceived fit, or satisfaction with major. Employment growth potential was also unrelated to measures of fit; it was, however, related to parental influence ($r = -.13, p < .05$), suggesting that students with higher levels of parental support tended to be less influenced by employment potential.

Results also show that the four measures of objective fit were correlated, as expected (see Tables 5 and 6). However, not all of the objective fit measures show the

Table 5: Means, standard deviations and correlations of between-person study variables.

	1	2	3	4	5	6	7	8	9	10	11
1. Academic C-index fit	--	.58**	.34**	.28**	.01	-.02	.05	-.13*	-.03	.04	.01
2. Academic WWM fit		--	.22**	.50**	.07	.06	-.05	-.08	-.03	.04	.00
3. Occupation C-index fit			--	.61**	.12	.10	.22**	-.09	.03	.01	-.01
4. Occupation WWM fit				--	.02	.10	.16*	-.05	-.01	.05	-.08
5. Perceived fit					(.78)	.69**	.11	.20**	.39**	.05	-.04
6. Major satisfaction						(.89)	.14*	.14*	.52**	.08	-.02
7. Work centrality							(.86)	-.07	.17**	.07	.04
8. Parental influence								(.89)	.21**	.01	-.13*
9. Goal selection self-efficacy									(.70)	-.01	.03
10. Differentiation										--	.00
11. Employment growth potential											--
Mean	9.88	3.71	10.33	3.75	5.17	5.25	3.93	5.06	3.55	22.94	2.39
SD	3.42	1.73	3.80	1.74	.97	1.22	.95	.96	1.10	9.32	1.07

Note: $N = 257$, alphas are on the diagonal. ** $p < .01$, * $p < .05$. Academic fit refers to fit of current (senior year) academic major with interests. Fit with academic and occupational choices are included here as between-person measures of objective fit.

Table 6: Correlation between different measures of objective fit between student interests and academic major at time of enrollment in college.

	C-index	WWM fit	Profile	Distance
C-index	--	.58**	.44**	-.30**
WWM fit		--	.53**	-.44**
Profile			--	-.23**

Note: a lower distance indicates a better fit; ** $p < .01$.

same relationships with other measures. For example, the correlation between parental influence and fit with academic major, when measured by WWM fit and C-index, was $r = -.07$ (ns) and $r = -.13$ ($p < .05$), respectively. Although both measures show inverse relationships between objective fit and influence, only the correlation with C-index is significant.

Hypothesis Testing

Academic Fit Stability

To best examine factors that influence stability, I focused on fit at five points during the first two years of college. I used multilevel modeling as the general approach to analyze within-person changes in fit (HLM; Bryk & Raudenbush, 1992).

As previously described, four different measures of objective fit were calculated. The HLM analysis was completed separately with each of the four fit indices as the dependent variable. In each case, I first examined null models (no predictors with random intercepts) to ensure there was sufficient variability in fit at the within-person level. The null model partitions variance in means into within-person and between-person components. I found significant random effects for intercept-only models for all four

measures of objective fit. Intraclass correlations (ICCs) were calculated for each model to estimate the percentage of variance in fit that is attributable to within-person factors.

Table 7 lists the model estimates as well as ICC values for each measure of fit. Measures of fit that were based on 3-letter codes had lower ICC values (i.e. higher within-person variance in fit) than the full profile measures of objective fit. This can be explained by the 6-letter profiles being a more specific definition of the person's interests, and a more specific classification of the environment. Both 3-letter models of fit had ICC values of .79, which corresponds to 21% of the variance attributable to within person variability in fit. The profile correlation had an ICC = .87, or 13% within person variance in fit. The Euclidean distance, the most specific of the four measures of fit, appears to be the most stable, with within-person variability accounting for only 6% of variance (ICC=.94).

Next, I used a level-1 model that included semesters as a predictor to test the first hypothesis, that students will change their academic major to improve their objective fit. Results were mixed. Three of the four fit measures showed fit slightly improving over the course of the first four semesters ($b = .06, .02, -.63$, for WWM fit, profile correlation, and Euclidean distance, respectively, $p < .05$). Only the C-index measures of fit did not show an improvement of fit over time. As previously discussed, the C-index differs from the other measures in that it weighs interests according to rank order in the profile, which makes it more sensitive to ranking of environmental characteristics.

Only one hypothesis was made regarding level-2 moderating effects. Because individual differences and situational factors are not captured longitudinally, only parental influence, assumed to be constant, was examined as a between-person moderating variable ($H2$). I tested the effect of parental influence on the stability of

objective fit in two ways. First, I modeled parental influence as a between-person (level-2, group-centered) moderator to the level-1 model described above. Results, detailed in Table 7, showed neither a significant main effect nor a significant interaction effect of parental influence on fit with major over time. Second, I looked at the correlation between measures of stability and parental influence. Table 8 shows the relationship between stability and study variables; the correlation coefficients between measures of stability and parental influence were not significant ($r < .1$, *ns* for all measures of objective fit).

To summarize, the within-person analysis of objective fit showed that the first hypothesis, that students tend to improve their fit over the course of their first two years in college, was generally supported (except for C-index). Students tended to change their majors to improve fit. However I found no evidence to support the hypothesis that parental influence would be positively related to stability of fit.

Table 7: Within-person effects on academic major choice for four measures of objective fit.

Predictor	C-Index	WWM fit	Profile Correlation	Euclidean Distance
	<i>b</i>	<i>b</i>	<i>b</i>	<i>b</i>
Intercept	9.93**	3.57**	.10**	43.26**
Semester	-.01	.06*	.02**	-.63**
Parental influence effects on				
Intercept	-.40	-.11	-.01	-.23
Semester	-.01	-.03	-.01	.59
ICC	.79	.79	.87	.94

Note: ** $p < .01$, * $p < .05$; note the effect of semester on objective fit is the slope in the relationship between semester in college and objective fit. A negative slope in Euclidean distance indicates a distance over the course of academic tenure, and therefore is an improvement in fit between the enrollment and the end of the fourth semester. ICC refers to the intraclass correlation for each measure.

Table 8: Correlation between measures of fit stability and relevant study variables.

	1	2	3	4	5	6	7	8	9	10	11
1. C-index fit stability	--	.77**	.50**	.53**	.01	-.06	.04	-.04	-.06	.01	.13*
2. WWM fit stability		--	.46**	.55**	.00	-.10	-.07	.00	-.05	-.04	.05
3. Profile correlation stability			--	.85**	-.05	.01	.01	.01	-.02	.00	.19*
4. Euclidean distance stability				--	-.01	.02	-.01	-.02	-.06	-.04	.22*
5. Occupational fit (C-index)					--	.59**	-.09	.22**	.10	.12	.01
6. Occupational fit (WWM)						--	-.03	.16*	.09	.02	.03
7. Parental influence							--	-.07	.14*	.20*	.01
8. Work centrality								--	.14*	.11	.07
9. Major satisfaction									--	.69*	.08
10. Perceived fit										--	.05
11. Differentiation											--

N = 257, ** $p < .01$, * $p < .05$.

Career Environment and Individual Differences

This investigation also considered the relationship between fit with academic major and fit with occupation. Traditionally, studies of person-vocation fit use academic majors as a proxy for vocational environment (Savikas, 2001). Here, they are treated as two separate vocational environments and the relationship between the two is considered. I used repeated measures ANOVA for all analyses comparing academic and occupational fit. Results from this analysis are summarized in Table 9.

I hypothesized that students would maintain or improve their fit when they selected occupations (*H3*). Recall that only 3-letter occupational classifications are available. Therefore, the investigation of objective fit across academic and occupational environments is limited to the WWM fit and C-index measures. Both measures of fit showed a positive correlation in fit between the academic and occupational environments ($r = .34$, and $r = .28$ for C-index and WWM, respectively; $p < .01$). If a student had a high fit with their academic major, then it is likely that he or she likely had a high fit with their occupation. The repeated measures ANOVA resulted in no significant effect of environment. For example, the mean WWM fit with major during senior year ($M = 3.72$; $SD = .11$) was not significantly different from the mean WWM fit with occupation ($M = 3.74$; $SD = .11$), $F(1,256) = .05$, *ns*. The third hypothesis was partially supported; students at least maintained their fit when they selected an occupation. As mentioned above, 70% of participants improved or maintained their level of fit between academic and occupational environments.

The next hypotheses examined the effects of three individual differences on the relationship between objective fit with academic major and objective fit with occupation:

goal-selection self-efficacy (*H4*), interest profile differentiation (*H5*), and work centrality (*H6*). Because both measures of fit yielded similar results, in what follows, I limit the discussion to the results from the WWM measure of fit. The results using C-index are listed in Table 9.

I expected to find a main effect of goal-selection self-efficacy. I hypothesized that students who were more confident in their ability to select career goals would have a higher level of objective fit in both career environments. However, there was no significant mean difference in fit between students with high and low self-efficacy ($F(28,228) = .71, ns$). The lack of support for this hypothesis is an indication that self-efficacy remains unrelated to objective fit, regardless of career environment.

I hypothesized that there would be an interaction between interest profile differentiation and career environment and that more stable profiles would be associated with higher levels of differentiation (*H5*). A repeated measures ANOVA showed a significant interaction between environment and differentiation ($F(41, 215) = 1.74, p < .01$). Students with low interest profile differentiation improved their objective fit when they identified an occupation. Their peers with a higher differentiation in interest tended to maintain their objective fit across environments. There was no significant main effect for differentiation. So, students with lower interest profile differentiation did not necessarily have lower levels of objective fit; they were, however, more likely to improve their fit across different career environments. Figure 8 illustrates the hypothesized and observed moderating effect of differentiation on the relationship between environment and objective fit. High and low differentiation are defined by ± 1 SD from the mean value for differentiation.

I also hypothesized that work centrality would have both a main effect and an interaction effect on the relationship of between career environments and objective fit (*H6*). The notion was that students with higher work centrality would consider their options for work during their school years and would therefore (1) select a major that would be a better fit with their interests compared to their peers with lower work centrality, and (2) that they would be less likely to change their fit when they selected an occupation. Only the interaction between environment and work centrality was supported. There was not a significant main effect of work centrality ($F(52, 204) = .71, ns$). In other words, students higher in work centrality did reliably have better objective fit than their peers with lower work centrality. They did, however improve their objective fit with career environment, whereas students lower in work centrality tended to experience a decrement in fit. Figure 9 illustrates this interaction effect for ± 1 SD from the mean value for work centrality. Interestingly, and perhaps reasonably, the interaction differed from the prediction in two key ways. First, students high in work centrality did not only maintain their fit, as hypothesized; objective fit increased across career environments. Second, students low in work centrality changed their fit across environments as predicted. However, they tended to *decrease* their fit from academic to occupational environment, not increase it as hypothesized. This can be understood by considering the following example. If Sally and Jane have similar interest profiles that align with a major in French literature, they will have similar fit with their academic environment. If Jane has higher work centrality compared to Sally, then French literature will play a more important role in Jane's image of work and she will be more likely to seek an occupation related to French literature. Because Sally is relatively lower in work

centrality, she may value those aspects of work, such as income, that would enable her to be able to pursue her interests outside of work. Sally would therefore be content in an occupation that is less compatible with her interests.

Figure 8. The interaction between environment and profile differentiation. The top figure illustrates the hypothesized relationship. The bottom figure shows the observed relationship. The low and high differentiation lines reflect one standard deviation below and above from observed mean score for differentiation, respectively.

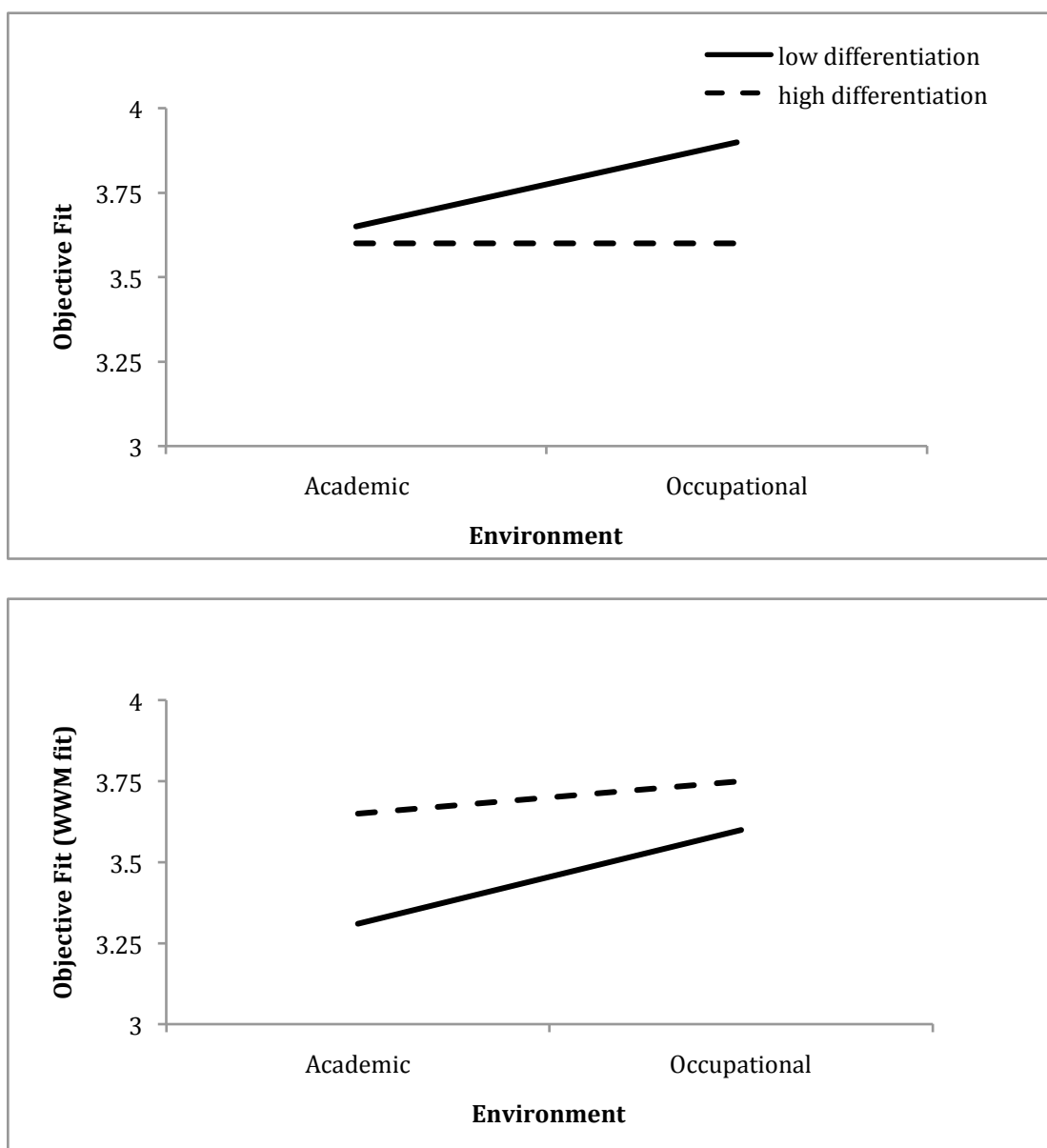
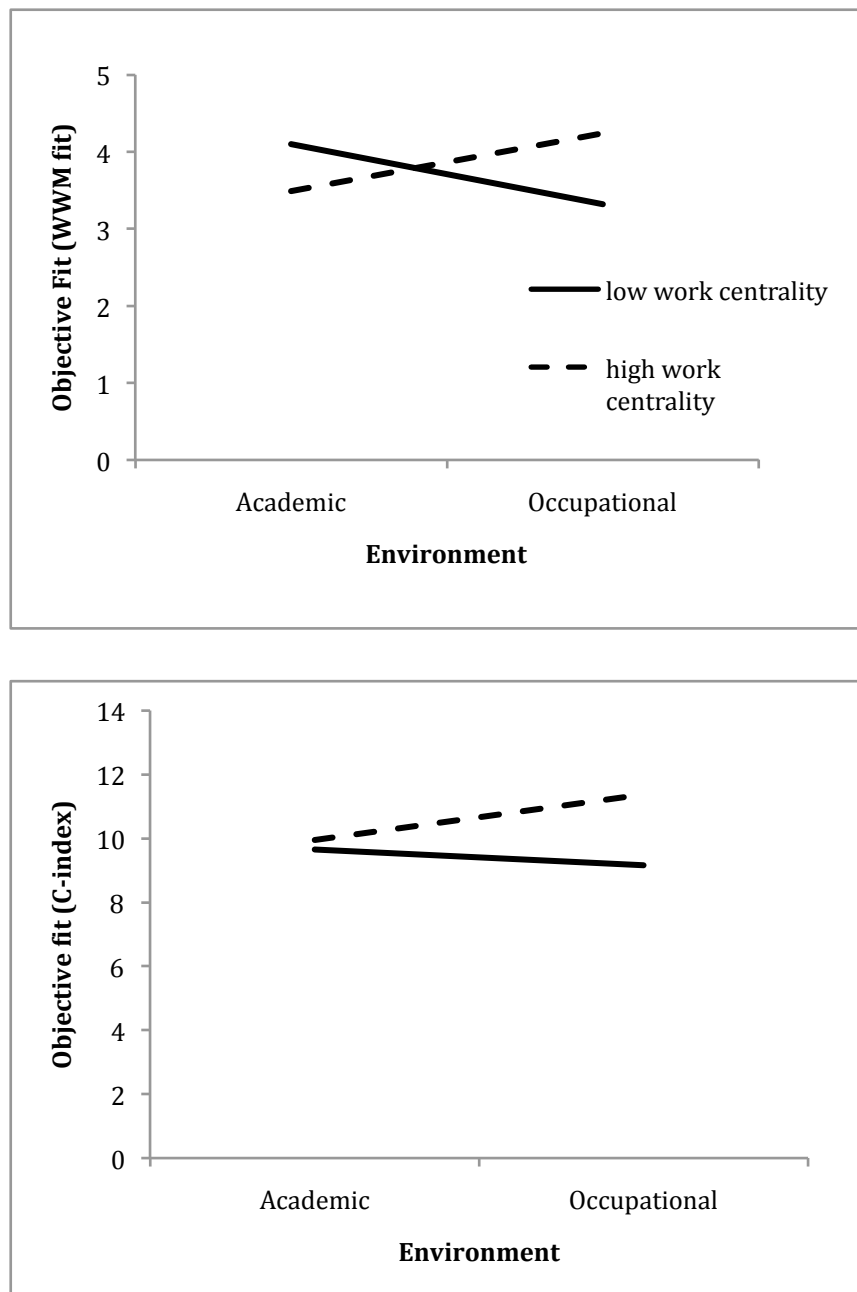


Table 9: Main and moderating effects of study variables on objective fit in academic and occupational environments.

Hypothesis	Measure of Fit	Effect	Type of Effect	df	F	p
<i>H3</i>	C-index	Environment	within	(1,256)	3.04	.08
	WWM fit	Environment	within	(1,256)	.06	.83
<i>H4</i>	C-index	Environment	within	(1,228)	.00	.98
		Goal selection self-efficacy	between	(28,228)	.83	.71
		Environment * self-efficacy	within	(28,228)	.91	.61
	WWM-fit	Environment	within	(1, 228)	1.11	.29
		Goal selection self-efficacy	between	(28,228)	.71	.86
		Environment * self-efficacy	within	(28,228)	1.03	.43
<i>H5</i>	C-index	Environment	within	(1,215)	.05	.82
		Profile differentiation	between	(41,215)	1.12	.30
		Environment * differentiation	within	(41,215)	1.77	.01

Hypothesis	Measure of Fit	Effect	Type of Effect	df	F	<i>p</i>
<i>H6</i>	WWM-fit	Environment	within	(1,215)	.01	.94
		Profile differentiation	between	(41,215)	1.04	.41
		Environment * differentiation	within	(41,215)	.74	.01
	C-index	Environment	within	(1,204)	3.2	.08
		Work centrality	between	(52,204)	1.19	.20
		Environment * work centrality	within	(52,204)	1.58	.01
	WWM-fit	Environment	within	(1,204)	.18	.67
		Work centrality	between	(52,204)	.71	.93
		Environment * work centrality	within	(52,204)	1.45	.04

Figure 9. Moderating effect of work centrality on the relationship between environment and objective fit. The top figure shows the relationship with objective fit measured by the World of Work Map measure. The bottom figure shows the relationship with object fit measured by the C-index measure of congruence. The low and high work centrality lines reflect one standard deviation below and above from observed mean score for work centrality, respectively.



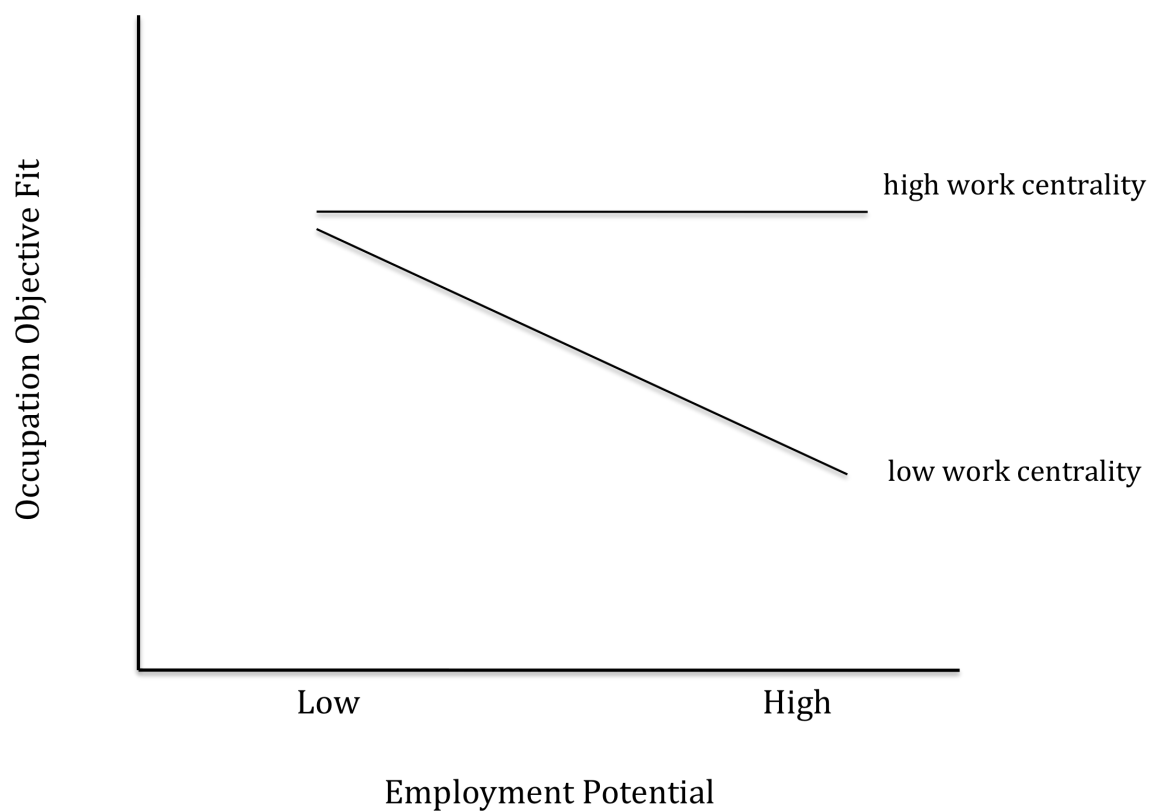
Occupational Fit

I considered the interaction between potential for employment and work centrality and its effect on fit with occupation. As shown in Figure 10, I hypothesized that work centrality would moderate the relationship between employment potential and fit with occupation; students higher in work centrality would be less likely to sacrifice fit for employment potential because their work would be more central to their identity.

To test this hypothesis, I used a linear regression to examine the effect of work centrality and the interaction between work centrality and employment potential on the relationship between occupational fit and employment potential. Only work centrality was predictive of occupational fit ($\beta = .16$ and $\beta = .22$ for WWM measure and C-index, respectively, $p < .01$).

To sum, students tend to maintain their level of fit between their academic majors and their chosen occupations after college (*H3*). Two individual differences appear to moderate the relationship between career environment and objective fit: interest profile differentiation (*H5*) and work centrality (*H6*). However, none of the tested individual differences had a significant main effect on objective fit.

Figure 10. The hypothesized relationship between employability and occupation fit, moderated by work centrality. Students high in work centrality would be more likely to consider work to be central to their self-concept and less likely to change their occupational choices because of employment potential. However, students with low work centrality are more likely to sacrifice fit with their occupation for the sake of employment.



Additional Analysis

Stability of Fit

In addition to the hypotheses listed above, I explored the relationship between objective fit stability and other study variables. Is there some benefit to a stable fit profile? Image theory is neutral on the benefits of stability of objective fit. On one hand, a person who explores a wide range of academic majors will have a highly variable objective fit profile, but will develop image clarity in the process. On the other hand, a person who begins college with a very clear value image will not change his or her academic major choice, resulting in a very stable objective fit profile. I tested the relationship between fit stability and satisfaction with academic major, perceived fit with major, and objective fit with occupational choice. Table 8 shows the correlations between the stability of fit and relevant between-person variables. All four measures of stability are correlated with one another. In three of the four measures of fit, more differentiated interest profiles appear to be more stable (e.g., $r = .13$, $r = .19$, $r = .22$, for C-index, profile correlation, and Euclidean distance, respectively, $p < .05$). WWM fit is the exception, perhaps because it is the measure with the lowest range (0 to 6) – fit intervals are broadest with this measure of fit, and variability is subsequently less. For the remaining measures of fit, the correlation between stability and profile differentiation supports Holland's conceptualization that profile differentiation is a measure of interest clarity; and images that are clearer are less likely to change. However, stability of fit was not correlated with desirable outcomes, such as a higher fit with occupation or a higher level of satisfaction with the major. This lack of a relationship suggests that there is no apparent benefit (or harm) when students consider a variety of majors.

Potential for Employment

I expected that the potential for employment would influence students' choices of occupations. I operationalized employment using the growth indicators available in O*NET. As described in the results above, this conceptualization of the hiring landscape proved to be limiting. Therefore, I also investigated the last hypothesis (*H7*) that work centrality would moderate the relationship between employment potential and occupational fit, using students' perception of the availability of work associated with their target occupations. Results were mixed. Only the WWM measure of objective fit partially supported the hypothesis. Both employment and work centrality were related to occupational fit ($\beta = -.14, p < .05$; and $\beta = .16, p < .01$, respectively). The interaction term was not significant. The same analysis using the C-index measure of fit found only work centrality to be a predictor of occupational fit ($\beta = .22, p < .01$).

CHAPTER 7: DISCUSSION

Broadly, the goal of this study was to contribute to our understanding of how people use vocational fit to make career decisions over time, and how career-related individual differences and environmental factors influence these choices. The college student population offers a unique opportunity to examine such questions, albeit in a very limited context, because students make several vocational choices in a relatively short timeframe, first in the form of academic majors, then in their choice of occupation after graduation.

Summary of Findings

Measures of fit. This study used four different measures of objective fit, two leveraged the 6-letter interest profile, and two used the first, highest-scoring three interest areas, or Holland code. I elected to use multiple measures of fit because each measure has its benefits and drawbacks, as summarized in Table 4. All four measures are susceptible to issues that arise due to the broad categorization of academic majors and occupations. However, there are additional considerations regarding when using each measure.

Three-letter measure of fit. In this study, C-index and WWM fit both use the three-letter interest profile to calculate fit. The C-index is a rank-order weighting scheme, which makes the measure sensitive to the order of the letters. The correspondence between the first letter of the interest profile and the major classification is weighted more heavily than the correspondence between the third letters, which makes this measure of congruence sensitive to the relative order of letters in the environment, which can be problematic. For example, consider a student with an interest code of IRC who

selects an occupation classified as RIC (same interest areas, different order). The C-index would rank this as a medium-level fit of 11, whereas measures that translate Holland's hexagon into two-dimensional space, such as the WWM fit, would rate this as a perfect fit (both RIC and IRC are in the same region of WWM). On the other hand, if the student chooses a major classified as IAC, two of the 3 letters are in the same order as the student's Holland code. The C-index in this case is a near-perfect fit of 16. The WWM measure would classify this fit as a moderate 4.

Six-letter measure of fit. Of the two measures that use the entire interest profile, Euclidean distance is the one more sensitive to differentiation in the classification of the environment. This study considers differentiation in student profile. However, when considering average scores for interest categories within a major, it is also possible to consider the differentiation in the major. Tracey, Allen, and Robbins (2012) have noted that lack of differentiation in the major results in a major that is more broadly defined and is therefore less sensitive to differences in the things-people/data-idea space. Take majors with the CIP code of 45, such as Sociology. The highest standardized interest score is 54.2 in Social, and its lowest score is 49.2 in Realistic interests (Allen & Robbins, 2010). So, not only are the highest and lowest scores near the mean, the profile differentiation is within half a standard deviation. This 'flat' major makes it less sensitive to differences in distance. A student with a less differentiated profile will, almost by definition, be a better fit. This lack of differentiation in the major will can result in comparable measures of fit for students in that major with very different profiles. The effect of this lack of differentiation can explain the low level of within-person variation in fit is measured with the Euclidean distance.

Given the pros and cons of all four measures, I view the WWM measure to be the best option for measurements of vocational fit because it does not over-emphasize the order of interest areas and it is less limited by the availability of environmental classifications.

Stability of fit. The level of variability of fit was a key element in this study. Academic institutions are concerned with how students select their majors, often citing the high percentage of who change their majors from when they enter college (e.g., Feldman et al., 1999). Both the pilot and the primary studies found that over half of participating students change their intended majors. This study shows that students seek to maintain or improve their academic fit. Further, stability of fit was not related to desirable measures, such as satisfaction with major, which suggests that there is not harm or benefit to variability in fit with major.

Differentiation. I hypothesized that there would be an interaction between differentiation and environment such that students with more differentiated profiles will be less likely to change their choice of major and students with lower interest profiles would improve their fit when they selected their occupations. There was a significant interaction between differentiation and environment; however, results showed students with less differentiated profiles *decreased* their fit when they selected their occupation. Figure 8 contrasts the hypothesized and observed interactions.

Work centrality. Of all individual differences examined, work centrality was the most compelling. Students higher in work centrality tended to be more satisfied with their choice of major and more confident in their ability to select career-related goals. Also, students higher in work centrality tended to have higher fit with their target occupations.

When applied to the relationship between different career environments, work centrality moderated the relationship between environment and fit such that students with high work centrality sought to improve their fit, whereas students lower in work centrality did not. The different relationship between work centrality in academic vs. occupational fit may be attributed to either the person or to the environment. A student may not relate their major choice during college to their occupation after graduation, or the occupational environment may be a more narrow (i.e., better) classification compared with academic majors. Considering the definition of work centrality, that work is central to a person's identity, it is likely that students high in work centrality associate major with occupation more than their peers lower in work centrality.

Image Theory as a Model of Vocational Fit

This investigation presented an integrated view of vocational fit that considered elements of compatibility, development, and decision-making based on image theory. The notion was that individuals will seek to improve their fit as they acquire information, and that situational variables, such as employment potential and parental influence, as well as characteristics of the decision-maker will influence fit.

Interest profile differentiation and work centrality played interesting roles in the relationship between career environment and fit. These individual differences moderated the relationship between career environment and fit. Differentiation is a reflection of image clarity, and work centrality is a reflection of how critical work, and by extension the career decision-making process, is to the person's self-concept.

Work centrality, in particular, supports the image theory interpretation of vocational choice presented here. Results from this study suggest that individuals with

higher levels of work centrality are more likely to adjust their vocational choices to better fit with their interests. The mean and standard deviation of work centrality in this study are comparable to those in other studies that use the Paullay et al. (1994) measure (e.g., Diefendorff, Brown, Kamin, & Lord, 2002), which implies that the current student sample responded to this measure in similar ways to studies of working adults.

An outstanding question is what affects overall fit. None of the main effects were significant. The characteristics of the decision-maker included in this study appear to influence changes in fit for the individual, but not overall levels of fit between people.

Study Limitations and Generalizability

There are four important limitations to this study that stem from either logistical considerations or the limited availability of proprietary information.

First, this study relied heavily on the assumption that interests are stable. This is not truly a longitudinal study: interests are measured at one point in time and students report their academic choices retrospectively. Ideally, this study would be conducted longitudinally, with interests and academic major choice assessed at each point. However, logistics and feasibility dictate a cross-sectional design that asks for retrospective assessments. However, given the evidence that interests are stable for young adults (Low et al., 2005; Tracey & Robbins, 2005), the stability of interests is a reasonable assumption to make, particularly when being measured with an instrument that has reliably found interests to be stable.

Second, the retrospective reporting relies on students' accurate recollection of what majors they considered, and will naturally include some level of bias. Further, the reporting by semester of intended major does not capture any variability within a

semester. For example, if a student considers five majors during his or her first semester, but then persists in the choice after that first semester, this study will show this particular student to have a stable profile.

Third, I asked students to identify their occupational choices. Their responses are a reflection of their career aspirations after graduation – choices that will become a reality 3-8 months from the planned time of survey administration, or perhaps later if they are taking a ‘gap’ year or attending graduate school. A more accurate depiction would be to obtain their occupational choices closer to graduation and again at few years after graduation. Here, again, feasibility required a simpler design. This study successfully tested the effects of interest profile differentiation and work centrality. Therefore, I plan to follow-up with participants in the weeks prior to graduation to confirm their post-graduation plans.

The fourth limitation is the lack of availability of adequate categorization of the environment (Arthur, Bell, Villado & Doverspike, 2006; Tracey, 2007). I relied on publically available classification of majors, which tend to be broad. Even though these definitions of majors do not allow for finer distinctions and specializations within the major, they are commonly used when evaluating objective fit in an academic context. The effects of this limitation are clear in the present study when one, well-established measure of objective fit yields different results from the others.

Finally, there are several factors that limit the generalizability of this study. Demographics of participants may limit the generalizability of this study. Over 66% of the respondents indicated that their primary household income was over \$100,000 per year. Less than 15% indicated that a household income of less than \$50,000 per year. The

implication of a more affluent group of participants is unknown – it may serve to affect how concerned students might be with potential for employment. Furthermore, participants in the current study attend an elite institution, which may also influence their expectations for employability.

Generalizability is also limited by the single-institution design of this study. Academic major options are limited to those offered by the schools and departments at Rice University. For example, Rice does not currently offer undergraduate degrees in agriculture, criminal justice, accounting, or marketing. As a result, the environment is limited to the Holland codes listed in Table 3. For example, there are no options in regions 4 and 5 of the World of Work Map that cover business operations (WWM; see Figure 2). A student interested in any of these majors is limited in his or her ability to improve objective fit. Therefore, this study is limited in its generalizability to a broader range of occupations.

Future direction and next steps

The results presented here are part of an ongoing investigation. This study is designed to allow performance in the major, the primary form of feedback to the student, to be included as a temporal predictor. Including performance in the major may provide additional insight to the within-person variability, or change in fit over academic tenure.

In addition to measures of performance, future analyses might include an investigation of change in fit within a college as well evaluating fit, and the stability of fit, by profile. Are some profiles more stable than others? For example, are students with high Artistic interests more likely to consider a wider range of majors? Tracey and Rounds (1996) considered prestige to be a third component or dimension of interests in

the data/ideas, things/people space. A broader sample, one that included students from multiple universities and areas of study, could be used to further explore the effect of prestige on vocational choice.

Above, I discussed the limitation introduced by broadly defined, poorly differentiated majors. To address this limitation, a differentiation term for the environment, or major, can be included in the analyses. For majors with full profile information, it is possible to compute differentiation for the environment (Tracey et al., 2012). The environment differentiation term may then be included as a moderator in the analysis of stability of objective fit.

Another consideration is to revisit the definition of stability. In this study, stability is defined as the least squares calculation of the fit trajectory. In other words, this definition assumes that fit will change over time and considers stability to be changes relative to this assumed progression. A more neutral definition might be to compute the overall change from either the maximum or the minimum.

In this study, the target occupation reflects the students' first occupation after college. This study does not speak to occupational fit at later point in time. This means that students who are lower in work centrality may simply take longer to increase their fit with their occupational choice compared to their peers with higher work centrality, or that work is not central to their self-concept, and objective fit with occupation may be less relevant for them. A follow-up study with participants, or a similar study using alumni one-to-five years out of college would further add to this research.

Conclusion

In addition to the overarching goals listed above, this study has specific implications for the academic advising and career counseling of undergraduates. Students will tend to improve their fit over their academic tenure. Students who consider their academic career to be important to their self-concept will likely continue to improve their fit when they select their occupation after college and rate their satisfaction with their choices highly. The lack of a relationship between perceived fit and objective fit can be incorporated into academic advising as predictors of different important college outcomes, namely satisfaction and performance, respectively (Wessel, et al., 2008). Students could benefit from a broad exposure to different majors (environments) that share their interests. Furthermore, there is no indication that considering many majors is either beneficial or detrimental to outcomes.

The fact that there was no main effect of work centrality or differentiation, however, is also telling. Even if a student considers their academic career to be central to his or her self-concept, their choice of major may or may not be his or her 'best' fit. Students who have more differentiated profiles do not appear to benefit from this image clarity. Results of this study show that students vary significantly in their levels of fit. However, this between-person variability cannot be accounted for by the individual differences or situational factors included in this study.

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APPENDIX: MEASURES

Satisfaction with Major

Nauta (2007)

Please rate the accuracy of the following statements where 1 is extremely inaccurate, 4 is neither accurate nor inaccurate, and 7 is extremely accurate.

I felt I had to select a major... registrar's deadline was approaching (R)

I think my major accurately represents my primary interests

I often wish I hadn't gotten into this major (R)

I wish I was happier with the major I have chosen (R)

Overall, I am happy with my choice of major

I feel good about the major I've selected

I would like to talk to someone about changing my major (R)

I feel like I considered all my options before selecting my major

Perceived Academic Fit

Schmitt, Oswald, Friede, Imus, & Merritt (2008)

The courses available at this school match my interests

I know other students here whose academic interests match my own

My current courses are not really what I would like to be doing (R)

All things considered, my current major suits me

I feel that my academic goals and needs are met by the faculty at this school

I am able to use my talents, skills, and competencies in my current courses

Parental influence

(Kenny, 1990)

Please rate the accuracy of the following statements where 1 is extremely inaccurate, 4 is neither accurate nor inaccurate, and 7 is extremely accurate.

In general, my parents...

Respect my privacy

Restrict my freedom or independence (R)

Take my opinions seriously

Encourage me to make my own decisions

Are critical of what I can do (R)

Impose their ideas and values on me (R)

Are persons to whom I can express differences of opinion on important matters

Have provided me with the freedom to experiment and learn things on my own

Have trust and confidence in me

Try to control my life (R)

Give me advice whether or not I want it (R)

Respect my judgment and decisions, even if different from what they would want

Do things for me, which I could do for myself (R)

Treat me like a younger child (R)

Work Centrality

(Paulley, Alliger, & Stone-Romero, 1994)

Below are a number of statements each of which you may agree or disagree with, depending on your own personal evaluation of work in general. Please indicate the degree of your agreement or disagreement with each statement by rating each of the following statements.

Work should only be a small part of one's life (R)

In my view, an individual's personal life goals should be oriented towards work

Life is worth living only when people get absorbed in work

The major satisfaction in my life comes from work

The most important things that happen to me involve my work

I have other activities in life that are more important than work (R)

Work should be considered central to life

To me, work is only a small part of who I am (R)

Most things in life are more important than work (R)

Overall, I consider work to be very central to my existence

I would probably keep working even if I didn't need the money

If the unemployment benefit was really high, I would still prefer to work